Section 3

Existing Resources

This section describes the existing conditions within and around the Poplar Island archipelago with respect to environmental, cultural, socioeconomic, and recreational resources. The existing environmental resources are the focus because, in this region, these resources are an integral part of the socioeconomics and most recreational options. This information is necessary for NEPA compliance. Further, a construction project of this magnitude has the potential to influence and be influenced by regional environmental conditions. The description provides a basis for measuring impacts associated with reconstructing Poplar Island using clean dredged material from the Baltimore Harbor and Channels Federal navigation project.

3.1 Environmental Resources

3.1.1 Setting

The group of islands known as Poplar Island is located in the upper middle Chesapeake Bay at latitude 38° 46' N, and longitude 76° 23' W. The site is approximately 32 miles southeast of Baltimore-Washington International (BWI) Airport, 35 miles east of Washington, D.C. National Airport and 32 miles north of Patuxent Naval Air Station (Figures 1-1 and 1-2). The closest point of mainland is GMPT on the eastern shore of Maryland just north of Tilghman Island, approximately 2 miles east of the site. The islands, which are situated on the main stem of the Bay near the confluence of the Chesapeake and Eastern Bays, are subject to severe erosional forces. The northern portion of Poplar Island, which exceeded 1,000 acres in the 1800's, has eroded to less than 5 acres today. The erosion has split the northern portion into four small islands (North Point Island, Middle Poplar Island, South Central Poplar Island, and South Poplar Island) collectively referred to as Poplar Island. Today, there are also two larger parcels: Coaches Island, which in 1847 was part of Poplar Island, and Jefferson Island, which was near, but separate from Poplar Island in 1847. Coaches Island currently has a surface area of approximately 74 acres. Jefferson Island is not part of the project area but has been included in discussions of available resources and impacts, where applicable (Figure 1-3).

3.1.2 Physiography, Geology, and Soils

3.1.2.a Physiography. Poplar Island is located near the eastern shore of the mid portion of the Chesapeake Bay and lies within the Embayed Section of the Atlantic Coastal Plain Physiographic Province (Hunt, 1967). The Coastal Plain is an elevated sea bottom with low topographic relief and extensive marshy tracts. Sloping gradually seaward from its intersection with crystalline rocks of the Piedmont Physiographic Province to the west, the Coastal Plain is characterized by estuarine embayments including the Chesapeake Bay, which divide it into a number of broad and low-lying peninsula tracts. The physiography has controlled both settlement and development in the coastal plain. From Long Island south to Cape Lookout in the Outer Banks of North Carolina, drowned valleys form the bays and harbors that favored early settlement of the Atlantic Coast.

Poplar Island formed over the last 10,000 years (during the Holocene) as rising sea level isolated former topographic highs on the mainland that now constitute the island complex. As inundation progressed, Poplar Island became first a peninsula and then an island. Since 1847, bayside erosion driven by wave action has resulted in the loss of 85 percent of the Poplar Island landmass. The island has been reduced from 1,100 acres in 1847 to about 79 acres today (USACE 1995). The Poplar Island archipelago is low-lying and possesses nearly level topography, as does the nearby mainland of Talbot County. Elevations on South Central and South Poplar Islands reach a maximum of 2 feet Mean Lower Low Water (MLLW). Elevations on Coaches Island reach a maximum of about 10.8 feet MLLW. The substrate is generally flat with slopes on the order of 1:300 to 1:500.

3.1.2.b Geology. Poplar Island is comprised of, and underlain by, Quaternary lowland sedimentary deposits consisting of gravel, sand, silt, and clay. These deposits form the materials of the existing islands and overlie nearby shallows. These deposits are underlain by the Choptank and Calvert Formations, which are Tertiary deposits at a depth of about 200 feet. These formations consist of interbedded brown to yellow fine gravelly sand to gray to bluish-green argillaceous silt, locally indurated to calcareous sandstones and predominant shell beds. These deposits are underlain by older Tertiary and Cretaceous sediments. Late Precambrian and Early Paleozoic crystalline rocks largely comprised of schists, gneiss, and granites, form the basement complex at about 1,000 feet below land surface (Gahagan and Bryant 1995a).

Subsurface borings at the project site provide more details regarding the site-specific subsurface stratigraphy (Gahagan and Bryant 1995a). Soil borings conducted in conjunction with this study indicated that the subsurface conditions consist of four strata. Stratum 1 is a surficial silty sand, generally composed of black, gray, and brown strata. Stratum 1 is absent in some areas, and occurs at a depth of up to 30 feet thick in other areas. Stratum 2 is composed of surficial silty sand underlain by soft to hard, light gray and tan mottled silty clay. Stratum 2 varies in thickness from 0 to 20 feet in the Poplar Island harbor region and varies in depth in the rest of the archipelago. Stratum 3 underlies the entire site at a depth of approximately 4 to 30 feet, and consists of stiff, dark gray, silty clay with pockets of silty sand. This stratum is considered a marine deposit and contains many shell fragments. Stratum 4 occurs sporadically throughout the archipelago, near the surface, and consists of very soft, normally consolidated recent deposits of gray silty clay. This stratum also occurs in channels that were eroded in the older sediments, and then refilled with more recent deposits. The locations of these eroded and refilled channels are unpredictable. Some such channels were encountered to the northeast of the site. This stratum varies in thickness from 5 to 30 feet.

The site is situated in a region that has historically experienced a moderate amount of minor earthquake activity. Although many earthquakes have been reported in the region there since the early 18th century, none have been major or of catastrophic proportion.

3.1.2.c Soils. Due to dynamic coastal processes and continuous erosion of Poplar Island, much of the soil has been disturbed and transported away by erosional forces; however, particularly where vegetative cover exists, some of the original soil profiles remain. The original soils of Poplar Island, as well as those of Talbot County, formed from marine sediments that were deposited during various geologic epochs (U.S. Department of Agriculture 1970).

Soils originally formed on the islands include some from the Mattapex and Matapeake series and consist primarily of deep, moderately well drained, dark-brown soils that are level to gently sloping. These soils developed on silty marine sediments and consist primarily of silt loams that retain moisture and are well suited for vegetative growth. They occur through many other areas in Talbot County where they support cultivated crops, woodlands, and developed areas. These soils are being actively eroded on Poplar Island and replaced by tidal marsh areas that are regularly covered with brackish or salt water on each flood tide. These areas have a silt or very fine sand surface layer containing organic matter; they support marsh vegetation including phragmites, marsh elder, and scrub vegetation.

Since Jefferson and Coaches Islands are not as severely eroded as the Poplar Island remnants, the soil types that occur there are relatively preserved and stabilized by vegetation, including woodlands. Soils on these islands consist primarily of fine sandy loams and silt loams of the Woodstown, Sassafras, Othello, Mattapex, and Barclay series. These generally occur on gentle slopes, are well drained, and are well suited for vegetation. Considerable areas of tidal marsh occur on the edges and periphery of these islands, where they are subject to periodic inundation.

Investigation of the four smallest islands remaining in the Poplar Island archipelago revealed deteriorating remnants of a previously more extensive land mass (EA 1995a). All of the islands are subjected to significant wind and wave effects including bank erosion. North Point Island and South Poplar Island are frequently inundated by tidal waters generated by excessive high tides and storm surges. Middle Poplar Island has received some protection from direct wave exposure by the placement of barges on its western side. Ten barges were towed to the site and sunk in 1993 in an effort to protect the remaining bird colony on Middle Poplar Island by slowing island erosion.

3.1.3 Hydrology/Hydrodynamics

In estuarine systems, hydrodynamics (the movement and cycling of water) influences a variety of factors, including the shape and stability of land masses, water and sediment quality, and the distribution of aquatic organisms. Significant changes in land masses (e.g., bulkheading, dredging, and creation) can alter the hydrodynamics in a region potentially impacting other land masses or resources. To establish the existing hydrodynamic conditions in the vicinity of the project area, hydrographic, topographic, and aerial survey data were collected from areas within and adjacent to the Poplar Island archipelago region. All survey data including site elevations are referenced to MLLW based on the 1960 to 1978 tidal epoch, and the Maryland State Plane, North American Datum 1983.

3.1.3.a Average Depths. A bathymetric map is presented in Figure 3-1. Water depth in and around the Poplar Island archipelago is 1 to 2 feet in waters in between or directly adjacent to the islets. Water depth increases to a depth of 6 to 8 feet over a distance of approximately 4,000 feet to the south, west, and east. North of the archipelago, the 6 to 8 feet depth of water extends 8,000 feet. Beyond this zone, the bottom slopes and depths become about 12 to 14 feet. A report prepared for this study in 1995 indicated that water depth increases to 60 to 100 feet in the shipping channel, which is approximately 12,000 feet west of the archipelago.

3.1.3.b Water Levels. Normal water level variations at Poplar Island are generally dominated by semi-diurnal astronomical tides, although wind effects can be important. Extreme water levels, on the other hand, are dictated by storm tides.

3.1.3.c Astronomical Tides. Astronomical tides dictate the size and length of inundation of the intertidal zone, which is a unique and often highly productive area within an estuary. Astronomical tides at Poplar Island are semi-diurnal. The mean tide level is 0.9 foot above MLLW; the mean tidal range is 1.2 feet and the spring tidal range is 1.8 feet National Ocean Service [NOS 1995]. Tidal datum characteristics for Poplar Island reported from the NOS are presented in Table 3-1. The difference in elevation between MLLW and National Geodetic Vertical Datum (NGVD) has been estimated at 0.35 foot for the project site. MLLW will serve as the datum for this project. An important elevation to be considered for habitat creation is the elevation of Mean Spring High Water (MSHW). MSHW is defined to be 2.4 feet above MLLW and, for this project, will be considered as the boundary between wetland and upland.

3.1.3.d Storm Surge. Design water levels in the study area are dominated by storm effects (i.e. storm surge and wave setup) in combination with astronomical tide. Storm surge is a temporary rise in water level generated either by large-scale extra-tropical storms known as northeasters, or by hurricanes. The rise in water level results from wind action, the low pressure of the storm disturbance, and the Coriolis force. Wave setup is a term used to describe the rise in water level due to wave breaking. Specifically, change in momentum that attends the breaking of waves propagating towards shore results in a surf zone force that raises water levels at the shoreline. A comprehensive evaluation of storm-induced water levels for several Chesapeake Bay locations has been conducted by the Virginia Institute of Marine Science (1978) as part of the Federal Flood Insurance Program. Results of this study are summarized in the water-level versus frequency curves presented in Figure 3-2, which provide water levels in feet above NGVD for various return periods.

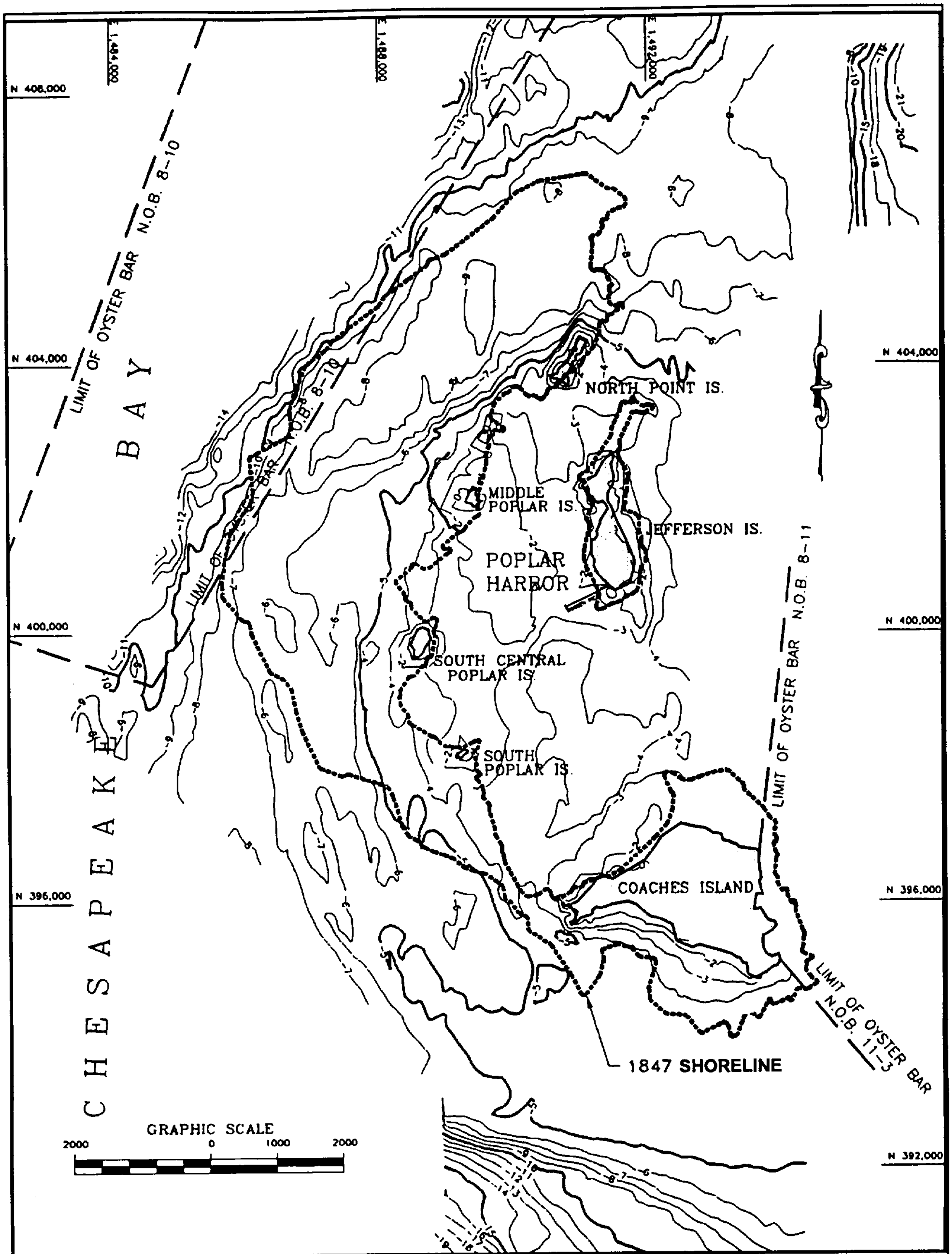


Figure 3-1. Bathymetric map.

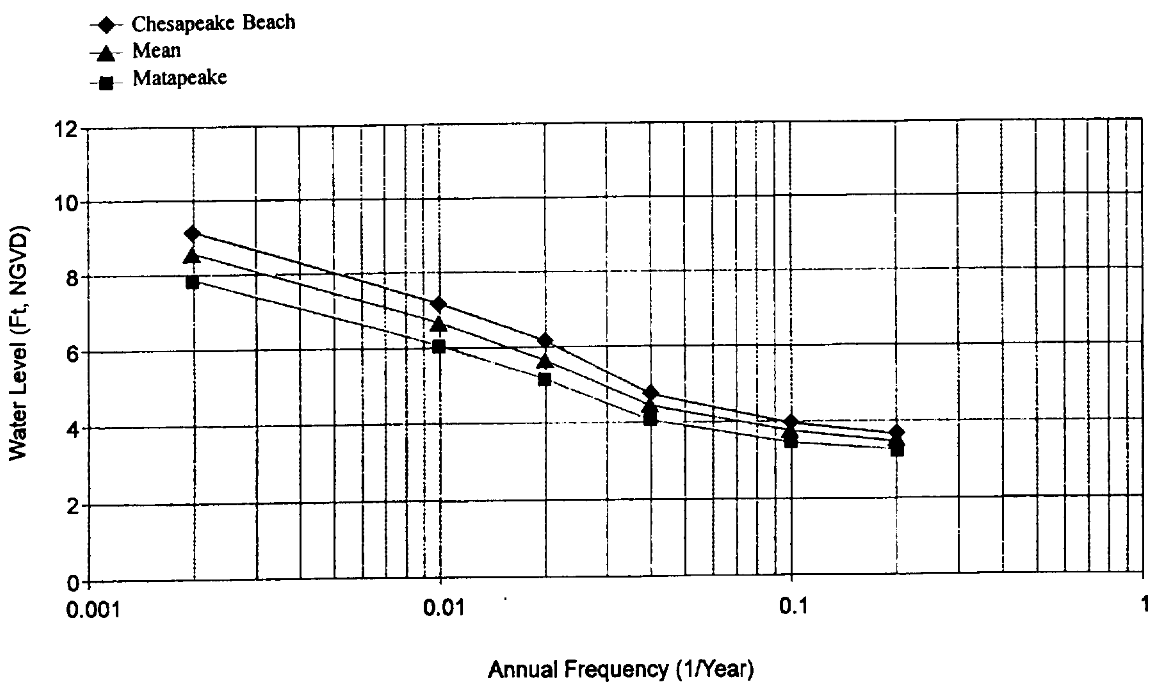


Figure 3-2. Water level versus frequency at selected Chesapeake Bay stations.

Table 3-1
Astronomical Tidal Datum Characteristics at Poplar Island

Tidal Datum	Ft (MLLW)
Mean Spring High Water (MSHW)	2.4
Mean Higher High Water (MHHW)	1.8
Mean High Water (MHW)	1.5
Mean Tide Level (MTL)	0.9
National Geodetic Vertical Datum (NGVD)	0.35
Mean Low Water (MLW)	0.3
Mean Lower Low Water (MLLW)	0.0

The closest station locations to Poplar Island are Matapeake on Kent Island, approximately 13 miles due north, and Chesapeake Beach on the western shore of the Bay, approximately 10 miles southwest. In the absence of other data, it has been assumed that the storm tides for Poplar Island are the mean values of the two locations. The mean is presented in Figure 3-2 in terms of water levels above NGVD for various return periods. Figure 3-2 indicates that the storm tide elevation for a 25-year return period is 4.9 feet MLLW (4.5 feet NGVD) and the 100-year water level for the project area is 7.0 feet MLLW (6.6 feet NGVD). For comparison, the 25-year return period elevations for Baltimore and Annapolis are 5.1 and 4.8 feet NGVD, respectively. A tidal gage has been installed at the Jefferson Island pier as part of this study; data collected from this gage will be used to correlate water levels with the above predictions.

3.1.3.e Wind Conditions. Aside from tidal currents, winds are the predominant hydrodynamic force in the Chesapeake Bay. Wind-driven waves are primarily responsible for the current erosion of Poplar Island. Design of any structures for construction within the Chesapeake Bay must consider the strength and prevailing direction of wind for the region. The design wind speeds for a 25-year return period storm range from 47 miles per hour (mph) for the east direction to 70 mph for the southwest direction. The design wind speeds presented in Table 3-2 have been used to estimate design wave conditions for the project site.

3.1.3.f Tidal Currents. Tidal currents are the speed that water flows into (floods) or out of (ebbs) an estuarine system. These velocities are variable within a cycle (flood to ebb or vice versa) and within a lunar cycle (full to half, half to new, etc.). The strength and velocity of these currents influence many factors, particularly sediment transport (e.g., erosion) and movements of some organisms (e.g., fish). Tidal flow patterns for the entire system, which are

Table 3-2
Design Wind Speed per Direction and Return Period
for Baltimore-Washington International (BWI) Airport

Return Period (Years)	Wind Speed and Direction (MPH)							
	N	NE	E	SE	S	SW	W	NW
5	40	37	32	37	36	47	50	54
10	48	44	38	45	43	56	54	59
25	59	55	47	58	54	70	60	67
50	69	65	55	69	63	82	64	73
100	81	76	65	82	74	97	69	81

dictated by bay geometry and the stipulated boundary conditions, are presented in Figures 3-3 and 3-4 by means of velocity vectors for flood and ebb conditions, respectively. Currents within the main bay channel in the vicinity of Poplar Island are on the order of 0.5 to 0.7 foot per second during peak flood and 0.4 to 0.8 foot per second during peak ebb. Detailed flow vector and velocity contour plots for Poplar Island are presented in Figures 3-5 and 3-6 for peak flood and Figures 3-7 and 3-8 for ebb flow conditions, respectively. These figures show that peak flood and ebb velocities east and west of the Poplar Island complex are on the order of 0.6 to 0.9 foot per second. Within the islands, however, the peak currents are on the order of 0.2 to 0.6 foot per second. As would be expected, velocities inside Poplar Harbor are relatively small.

3.1.3.g Sedimentation. Sedimentation can be defined as either filling (accreting) or cutting (erosion). The rates at which these occur within an area dictate the necessary level of protection needed to protect shorelines. Modeled simulations of these processes can be done based upon the predominant sediment types, hydrodynamics, and wind speeds in an area. Hydrodynamic projections based on boundary conditions were used to evaluate sedimentation processes for the project. Wind can play a consequential role in sediment transport. Wind-induced waves increase shear stress at the bottom surface and therefore have enhanced flow ability to suspend sediments that are then transported by currents. Based on wind observations at Patuxent Naval Air Station and BWI Airport, it is judged that the most frequent winds come from the directions of west, northwest, southwest and south. Northwesterly and southerly winds with different speeds were considered in the simulations, since they have relatively longer fetches, thus generating greater waves, especially for winds from the south.

Sediment transport was modeled separately for sand and clay. Physical parameters used in modeling are presented in Tables 3-3 and 3-4 for sand and clay, respectively. A cohesive sediment concentration at the northern boundary was estimated based on the measurements around the Poplar Island area. The southern boundary concentration was determined internally in the model. In the same fashion, an inflow sediment concentration was estimated for noncohesive sediments.

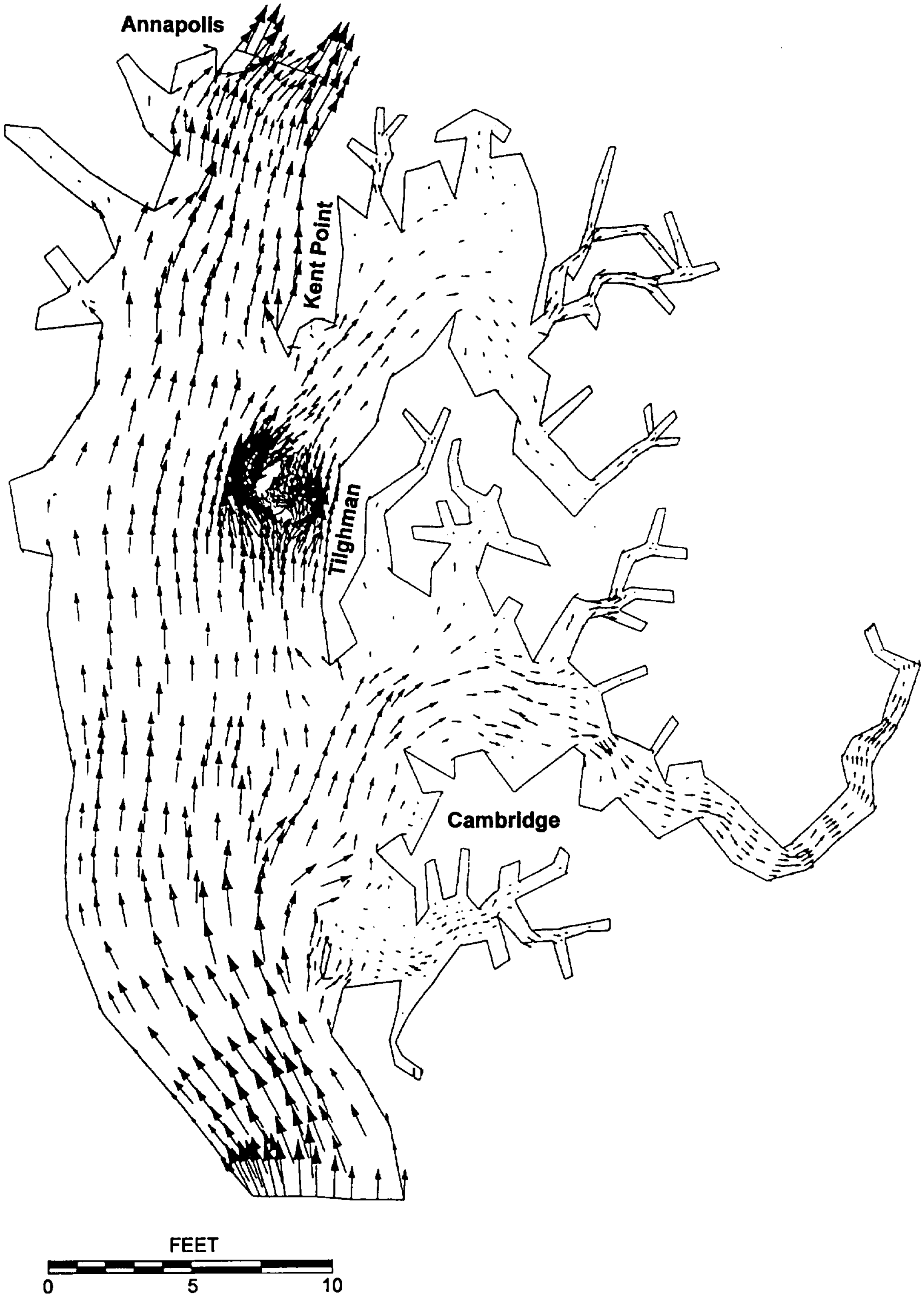


Figure 3-3. Flow velocity vectors for peak flood tide.

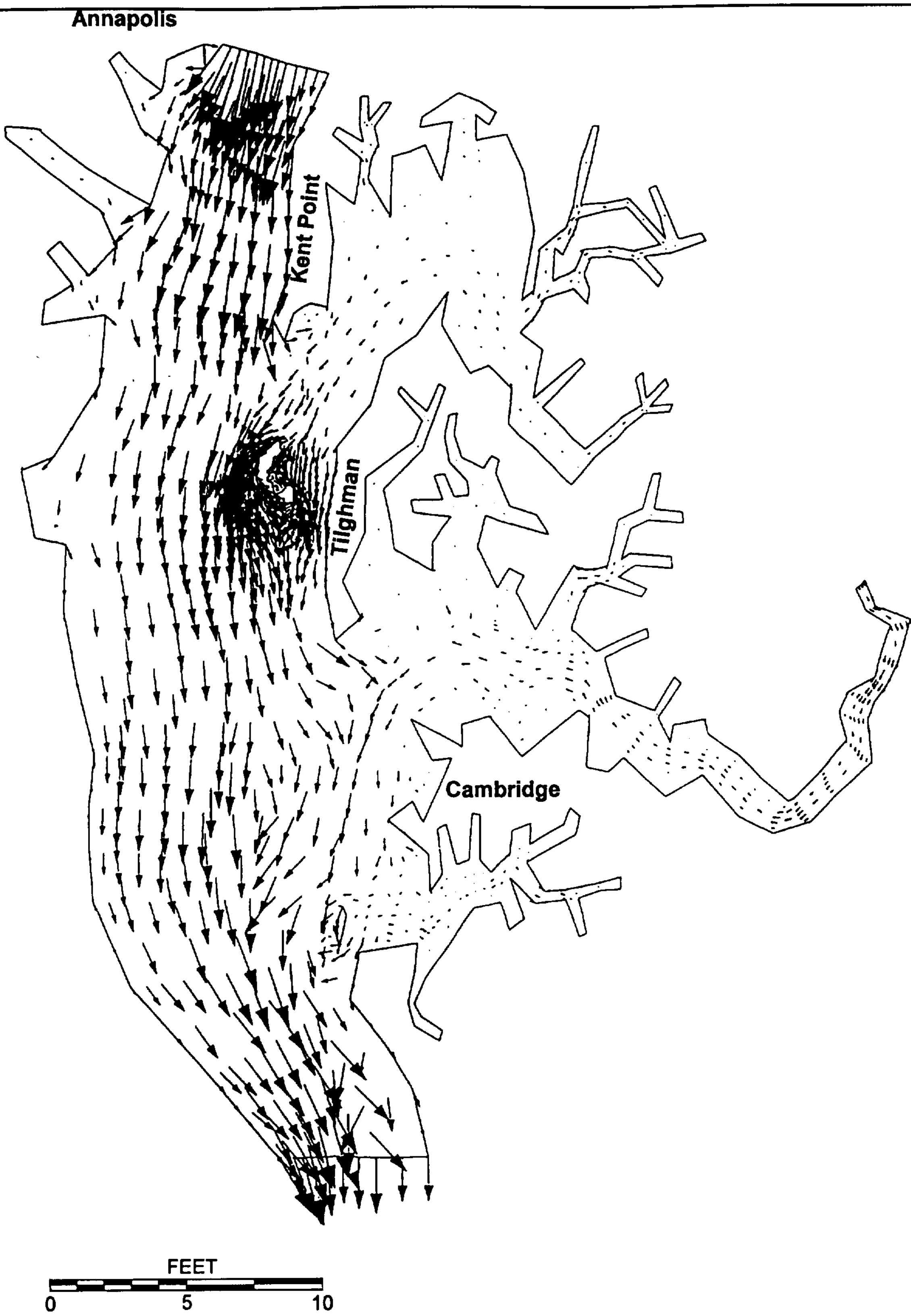


Figure 3-4. Flow velocity vectors for peak ebb tide.

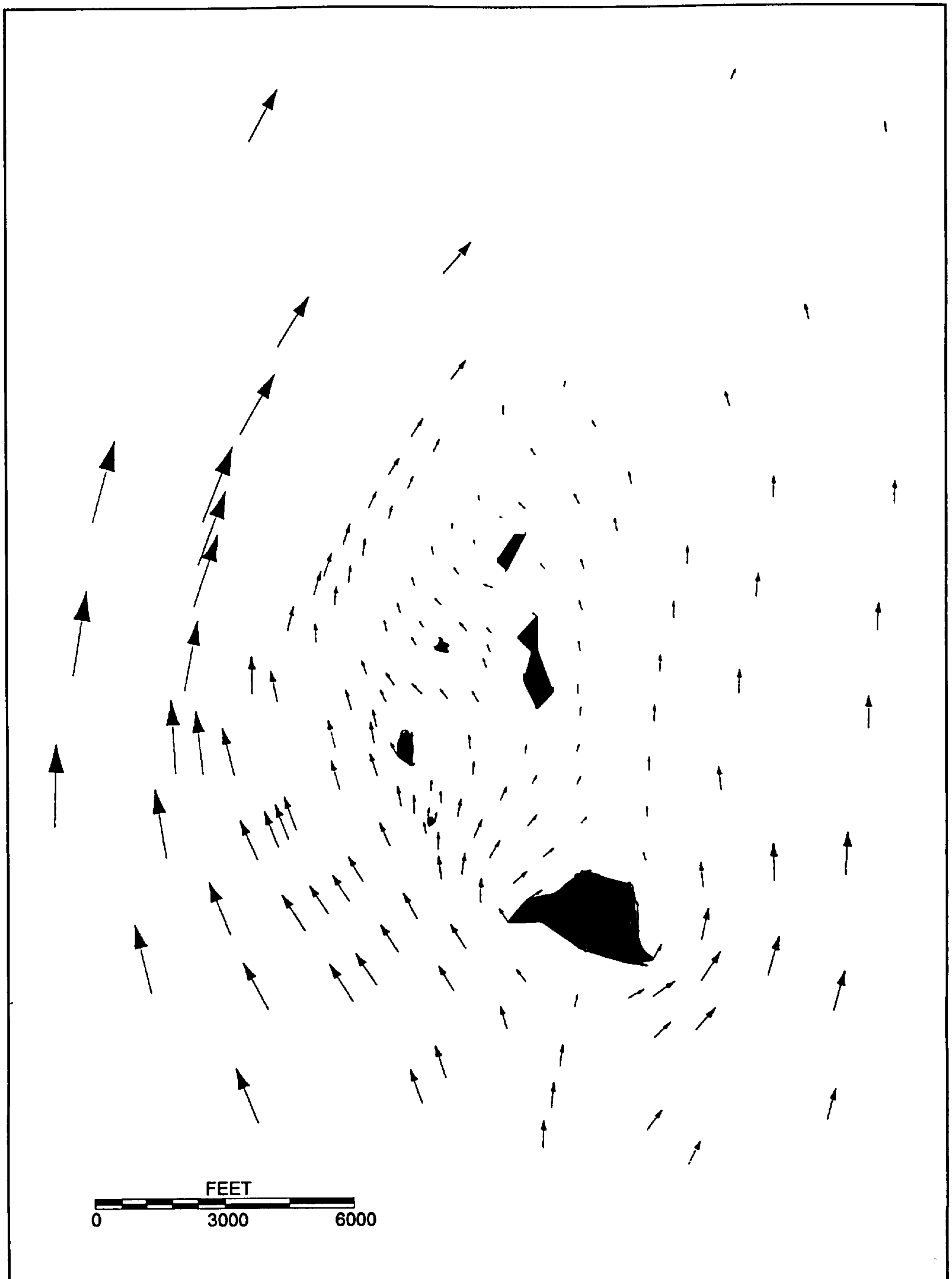


Figure 3-5. Site detail for existing conditions—peak flood.

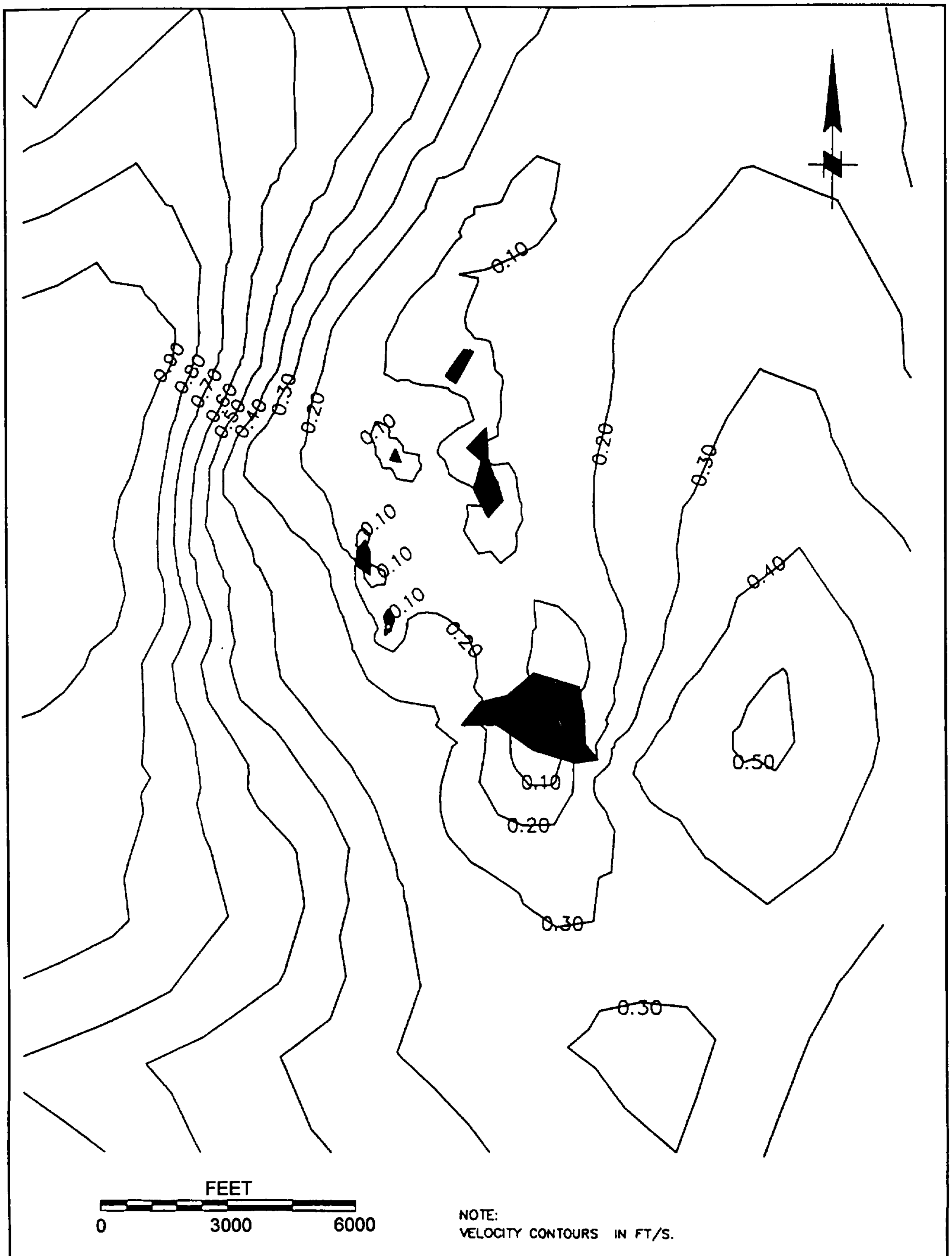


Figure 3-6. Velocity contour plot for existing conditions—flood tide.

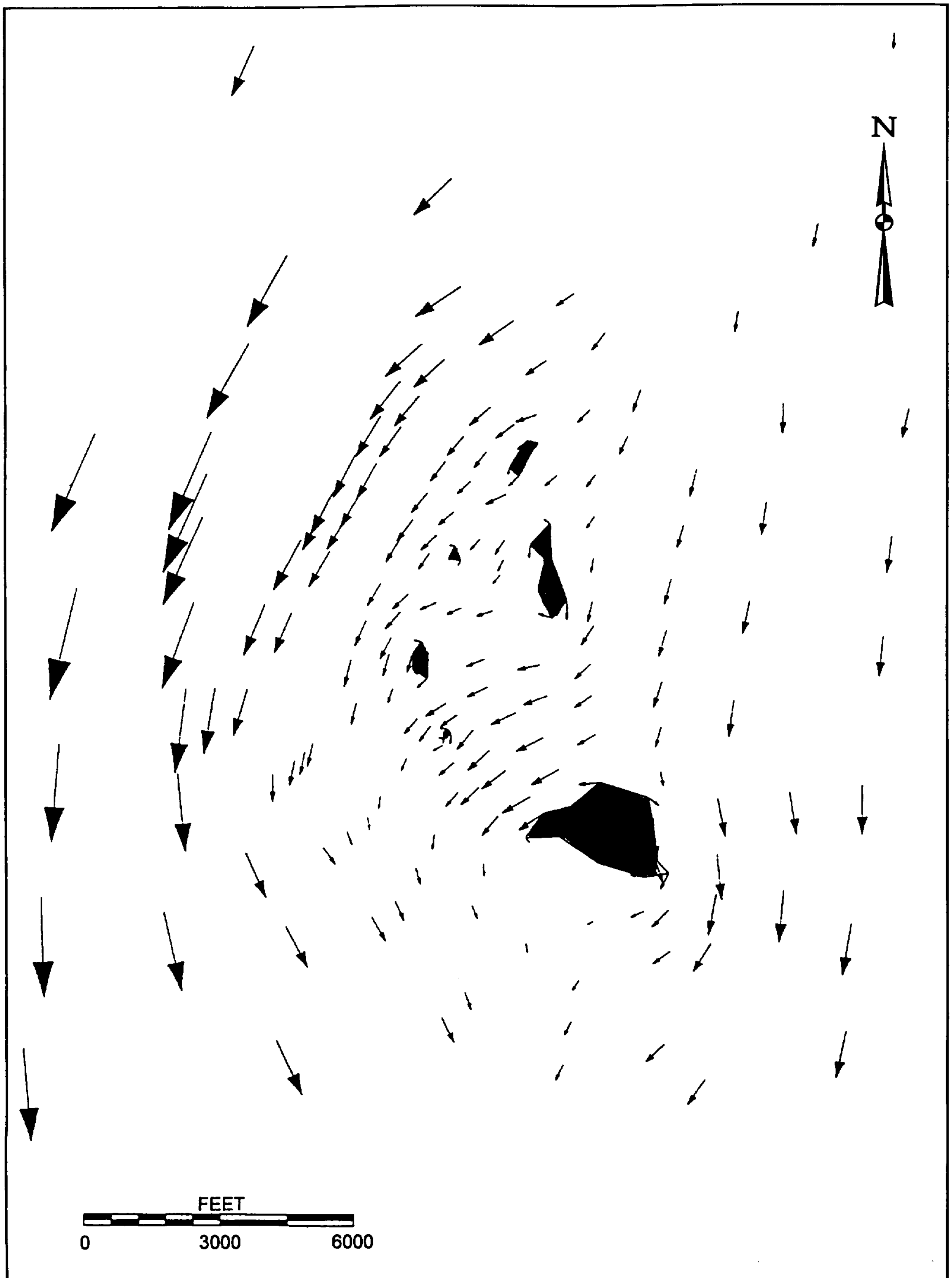


Figure 3-7. Site detail for existing conditions—ebb tide.

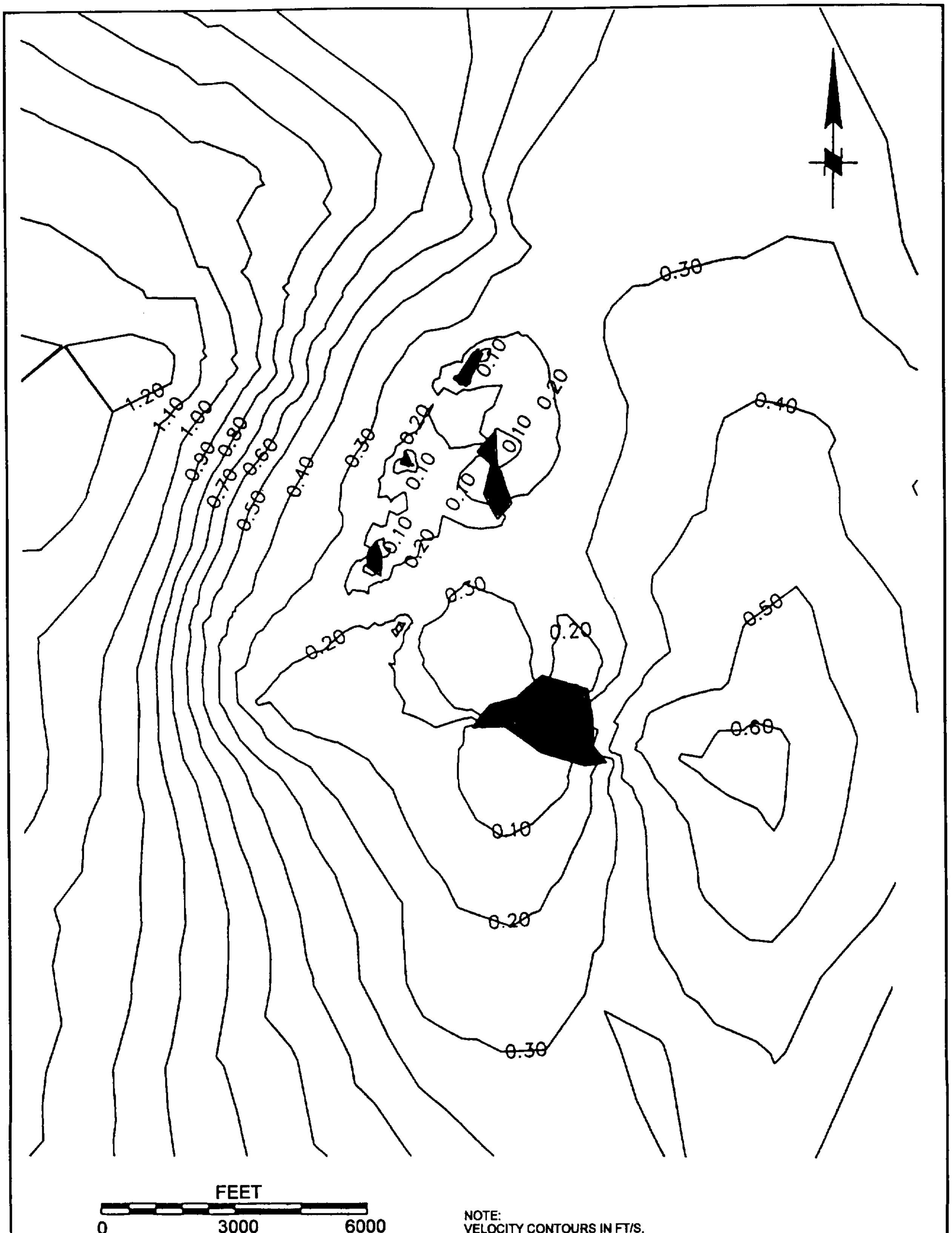


Figure 3-8. Velocity contour plot for existing conditions—ebb tide.

Table 3-3
Cohesive Sedimentation Parameters

Model Parameters	Units	Values
Crank-Nicholson THETA		0.66
Critical shear stress (deposition)	N/m**2	0.05
Critical shear stress (erosion)	N/m**2	0.15
Dry density of freshly deposited sediment	kg/m**3	300
Particle specific gravity		2.65
Erosion rate constant	kg/m**2/sec	0.002
Effective diffusion	m**2/sec	50
Inflow concentration	kg/m**3	0.02
Settling velocity	m/sec	0.0003
Initial concentration	kg/m**3	0.02

Table 3-4
Noncohesive Sedimentation Parameters

Model Parameters	Units	Values
Crank-Nicholson THETA		0.66
Particle shape factor		0.70
Length factor (deposition)		0.50
Length factor (erosion)		10
Particle specific gravity		2.65
Median grain size	mm	0.2
Effective diffusion	m**2/sec	50
Inflow concentration	kg/m**3	0.001
Settling velocity	m/sec	0.005
Manning's n		0.025

For the existing condition, sedimentation modeling of 1-month duration was performed for a northwesterly wind with a speed of 20 mph and a southerly wind with a speed of 15 mph. For a sand bottom, the Poplar Island area experiences erosion while deposition occurs at the area between the island and the main deep channel. Erosion is found for the whole island area when the bottom material is clay. Under the action of a southerly wind, erosion occurs around the Coaches Island area.

3.1.3.h Wave Conditions. Poplar Island is exposed to wind-generated waves approaching from all directions, which are the predominant cause of the current erosion. The longest fetch distances to which the site is exposed correspond to the north and south directions. In accordance with procedures recommended by the Shore Protection Manual (USACE 1984), a radially averaged fetch distance was computed for each direction. The radially averaged fetch distances for the north, northeast, east, southeast, south, southwest, west, and northwest are 18, 10.4, 2.6, 2.9, 24.2, 10.1, 8.4, and 9.3 miles, respectively. Wave conditions were hindcast along each fetch direction for the design winds presented in Table 3-2 (adjusted appropriately for duration) and the water levels presented in Figure 3-2. Specifically, waves were hindcast for eight directional design wind speeds (i.e. the design wind speeds computed for each individual directions using methods published in the Shore Protection Manual (USACE 1984). Wave hindcast results are presented in Figures 3-9 (significant wave height, H_s) and Figure 3-10 (Peak Wave Period, T_p). These figures present a summary of H_s and T_p that provide an immediate understanding of the directions from which the highest waves and longest periods approach Poplar Island.

A sea state is normally composed of a spectrum of waves with varying heights and periods which may range from relatively long waves to short ripples. To summarize the spectral characteristics of a sea state, it is customary to represent that wave spectrum in terms of a distribution of wave energy over a range of wave periods. Having made this distribution, known as a wave spectrum, it is convenient to represent that wave spectrum by a single representative wave height and period. The wave conditions reported in Figures 3-9 and 3-10 are the significant wave height, H_s, and the peak spectral wave period, T_p. The significant wave height, H_s, is defined as the average of the highest one-third of the waves in the spectrum. Depending on the duration of the storm condition represented by the wave spectrum, maximum wave heights may be as high as 1.8 to 2 times the significant wave height. The peak spectral period, T_p, is the wave period that corresponds to the maximum wave energy level in the wave spectrum.

The highest waves are estimated for the north and south fetch directions. The 25-year return period waves for the north direction have a significant height, H_s, of 7.2 feet and a peak spectral wave period, T_p, of 5.2 seconds. The 25-year return period significant wave height, H_s, for the south direction is 7.0 feet and the peak spectral wave period, T_p, is 5.4 seconds.

3.1.4 Water Quality

3.1.4.a Introduction. Water quality can influence the distribution and abundance of the living resources within an aquatic system. Analysis of water quality includes measurement of a variety of physical properties and chemical constituents that are known to be limiting to key species or groups of organisms or that are known to affect the health of an ecosystem to some extent. Physical variables include temperature, pH, conductivity, salinity, dissolved oxygen, turbidity, and water clarity. Chemical variables include elemental nutrients such as nitrogen, phosphorous, and silicon, which are essential constituents of biota.

Water quality varies spatially, temporally, and seasonally in the Chesapeake Bay, and year to year variability due to weather conditions is often significant. Nutrients and sedimentation from both point and non-point sources, physical mixing, and biological processes all influence water quality. Physical components of water quality are often influenced by weather events, daily tidal

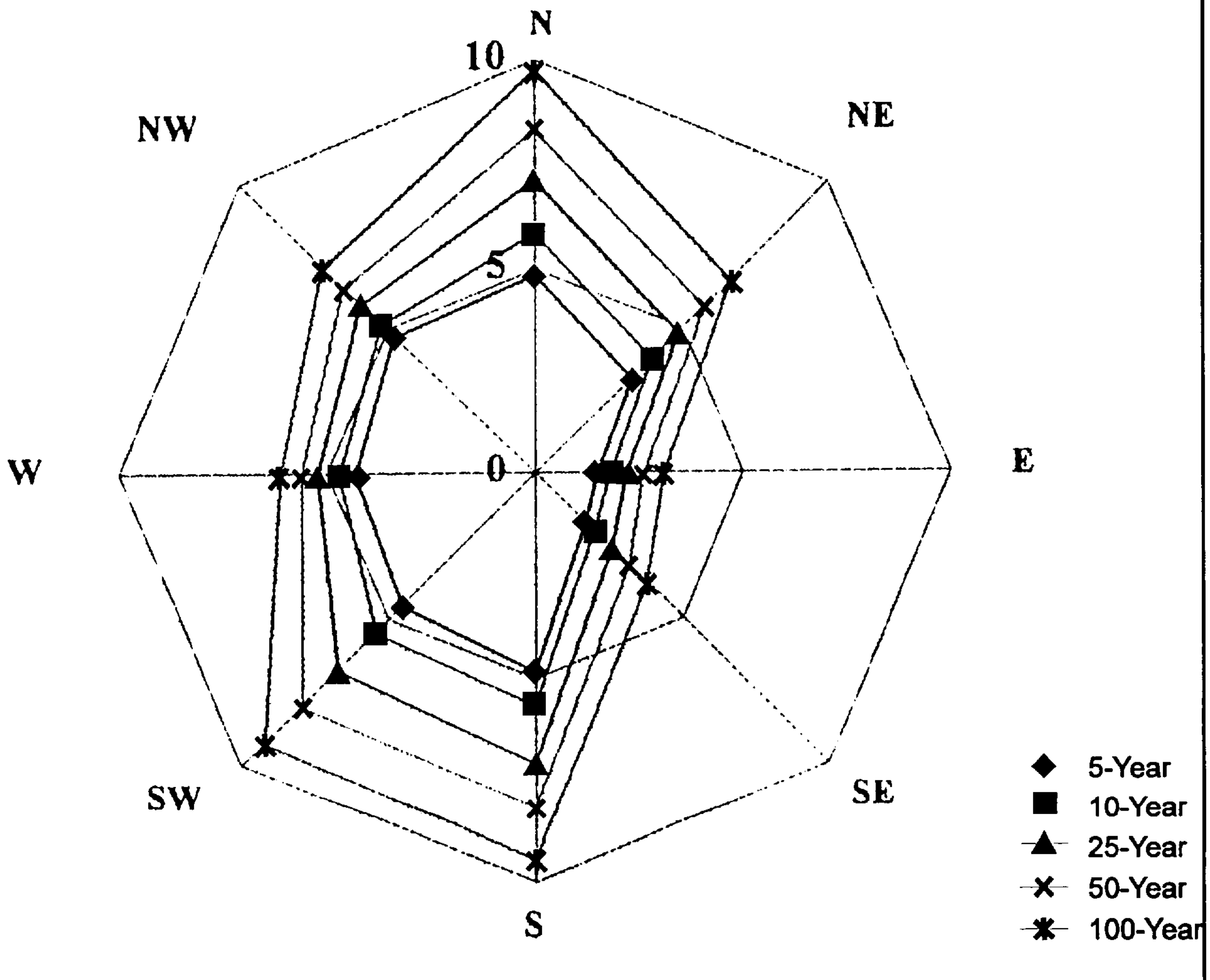


Figure 3-9. Offshore significant wave height (ft).

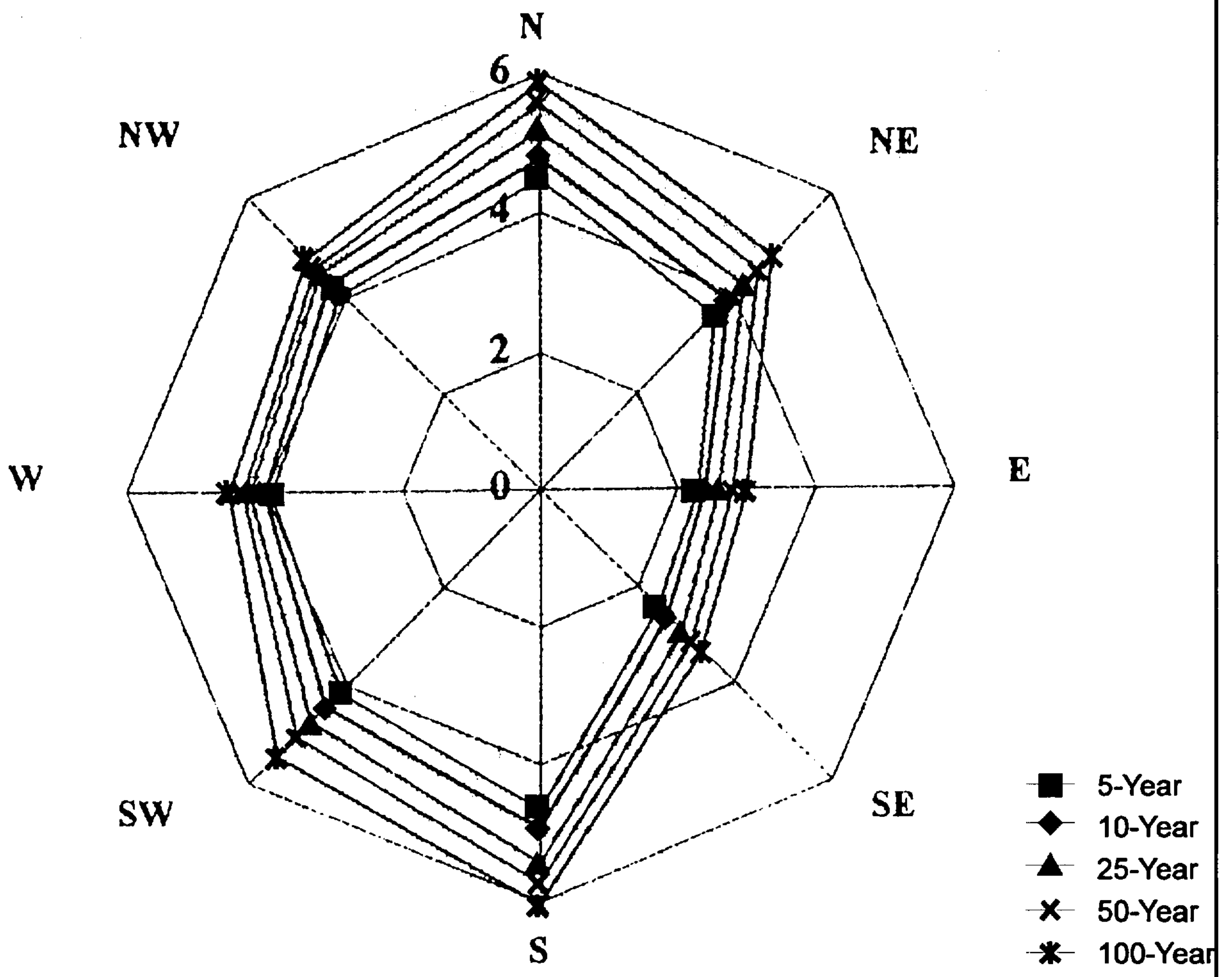


Figure 3-10 Offshore peak wave period (second).

cycles, and seasonal temperatures. Inorganic constituents are influenced by inputs such as atmospheric deposition, land discharge, and sewage treatment outfalls as well as biological processes such as algal photosynthesis.

Quarterly water quality sampling was conducted in the vicinity of the Poplar Island archipelago in October 1994, March 1995, May 1995, and July 1995. The data collected represent the most recent and complete description available for seasonal water quality characteristics in the vicinity of the islands. Other sources of comparable long-term water quality data for the eastern portion of the mainstem Bay from Kent Point to the Choptank River are limited. Maryland's Chesapeake Bay Water-Quality Monitoring Program (CBWQM), funded by the Chesapeake Bay Program since 1984, monitors 22 stations in the mainstem Bay and measures indicators of chemical, physical, and biological quality. This data set provides the only other comparable seasonal information on physical and chemical water quality in the vicinity of the Poplar Island archipelago. MDE has a monitoring station within Poplar Harbor, but the monitoring is restricted to fecal coliform in oyster tissues.

Five years of water quality data (1990-1994) from the CBWQM were summarized for the monitoring station closest to Poplar Island (station MCB4.1E). Station MCB4.1E is located outside the mouth of Eastern Bay off Kent Point (Figure 3-11), approximately 5 miles north of the Poplar Island archipelago. Total depth of the water column in this area is approximately 65 to 75 feet. For comparison, water quality data for the upper 15 to 16 feet of the water column at station MCB4.1E, will be used since this will most closely resemble conditions in the shallow archipelago (3 to 12 feet water column depth). The most recent 5 years of data were chosen for a representative comparison to existing seasonal conditions. Means and ranges for physical parameters and ranges for nutrients in the top 15 to 16 feet of the water column at MCB4.1E are presented in Table 3-5 and Table 3-6 and will be used for comparisons to Poplar Island's existing conditions.

3.1.4.b Existing Seasonal Conditions. Quarterly *in situ* water quality sampling was conducted at 10 stations in the fall and 14 stations in the winter, spring, and summer at the Poplar Island archipelago (Figure 3-12). Chemical constituents were measured at 10 locations in the fall, 14 in winter, and 5 in both spring and summer. Data collection methods were similar to methods employed by the CBWQM. A complete description of sampling locations, dates, methods, and measured constituents are described in the quarterly data reports (EA 1994a, 1995b, 1995c, 1995d). Means and ranges of physical and chemical variables by season are presented in Table 3-7 and Table 3-8, respectively.

The *in situ* seasonal physical water quality variables measured represent typical seasonal conditions for a shallow water area of the middle Chesapeake Bay. Water quality was uniform throughout the water column during all seasons, indicating that the water column was well mixed both vertically and horizontally. Water temperatures in the archipelago exhibited typical seasonal trends. Slight temperature stratification occurred in the spring and summer, with surface water temperatures minimally elevated due to solar heating. Seasonal mean water temperatures recorded during quarterly sampling fell within the range of values reported for MDE station MCB4.1E for 1990 to 1994. Winter water temperatures recorded in the archipelago were slightly lower than mean surface water values recorded in previous years at MCB4.1E. Nearshore areas normally freeze first in cold weather conditions, so these temperatures are not unusual.

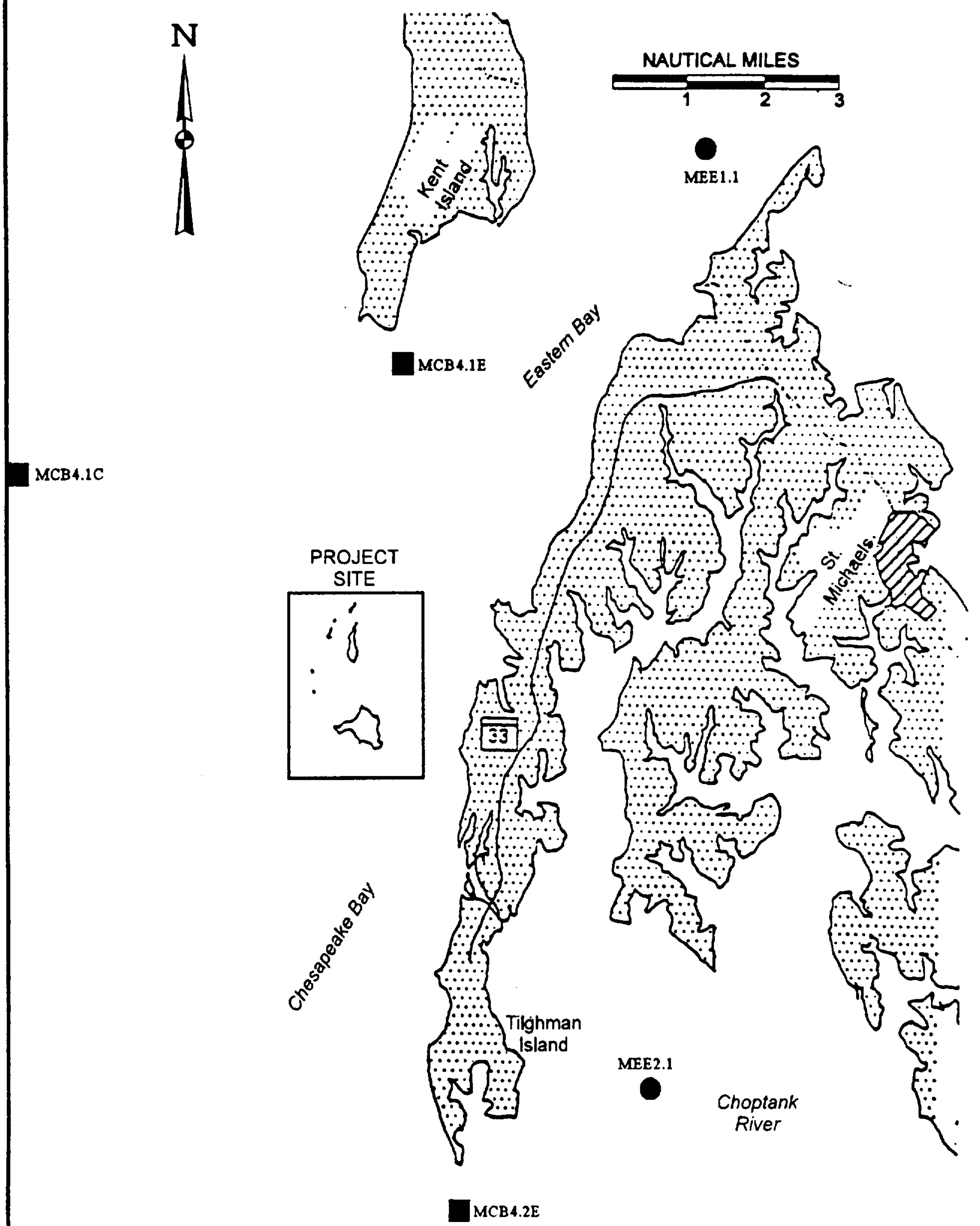


Figure 3-11. State water quality stations in proximity to project site.

Table 3-5 Mean And Range Of Water Quality Variables For The Upper 5m At Maryland's Chesapeake Bay Water Quality Monitoring Program Station MCB4.1e. Means And Ranges (In Parentheses) Were Calculated Using Values From Yearly Seasonal Sampling That Closely Coincided With Dates Of EA Seasonal Sampling In 1994-1995.

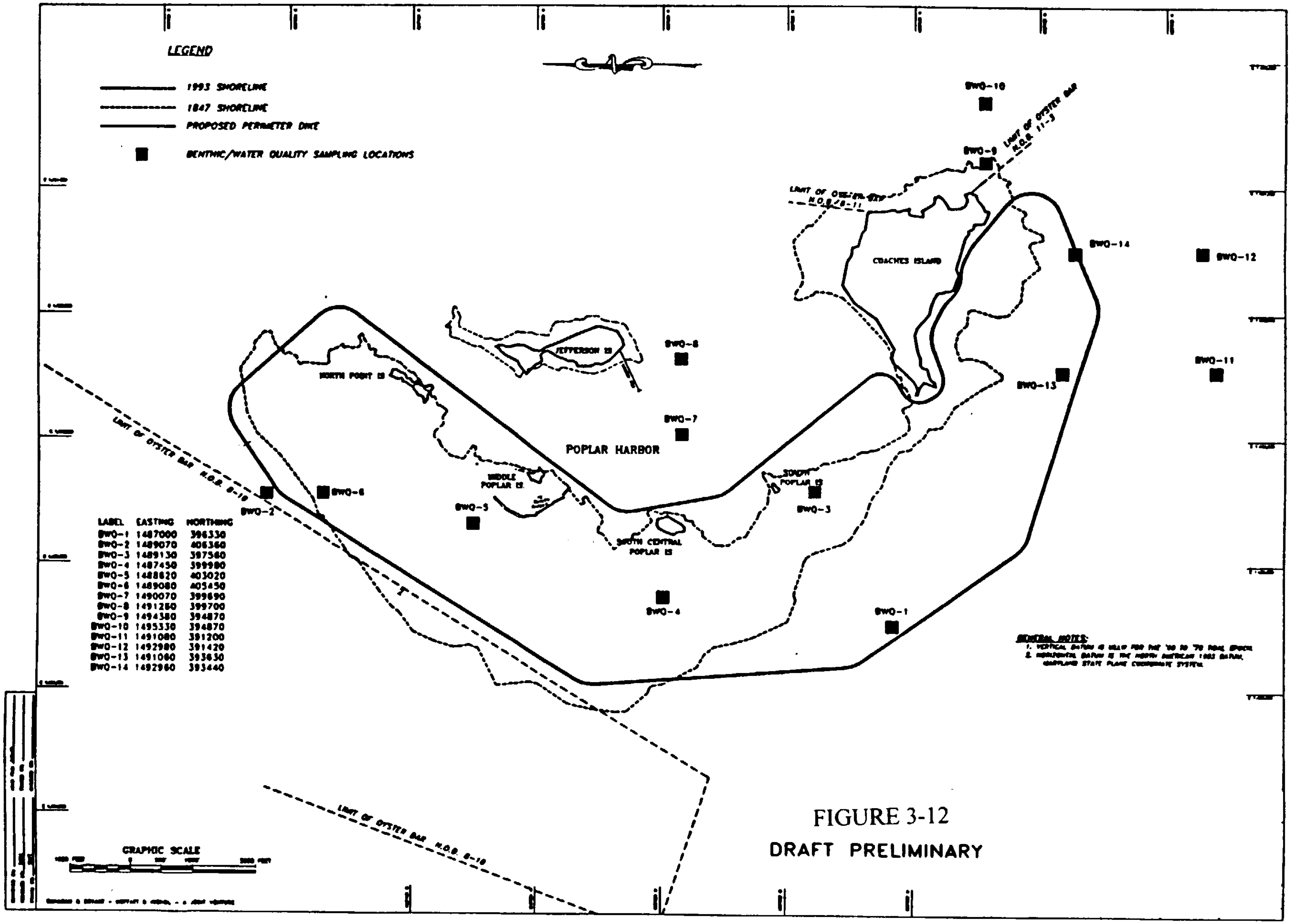
Season	Year	Water temp (°C)	pH	DO (mg/l)	Salinity (ppt)
Fall	1990	18.1 (14.7-21.1)	7.8 (7.7-7.9)	8.0 (7.0-8.8)	12.3 (9.3-14.2)
	1991	20.1 (18.6-21.5)	7.8 (7.7-7.8)	8.0 (7.2-8.5)	16.2 (16.0-16.2)
	1992	17.1 (15.6-18.4)	8.0 (7.9-8.0)	8.5 (8.1-8.7)	14.7 (14.5-14.7)
	1993	17.1 (16.5-17.5)	7.8 (7.7-7.9)	8.3 (7.8-9.2)	15.1 (14.7-15.2)
	1994	NA	NA	NA	NA
Winter	1990	7.1 (4.6-9.4)	7.9 (7.0-8.1)	11.1 (10.6-11.7)	8.9 (8.6-9.5)
	1991	7.0 (5.9-8.3)	8.0 (7.6-8.2)	10.9 (9.4-12.2)	9.1 (8.1-10.1)
	1992	6.6 (6.5-6.8)	8.0 (7.9-8.0)	10.9 (10.5-11.5)	14.8 (13.7-15.9)
	1993	4.7 (4.2-5.7)	8.0 (7.8-8.1)	12.1 (11.5-12.8)	12.7 (11.5-13.5)
	1994	4.2 (2.7-5.8)	8.2 (8.0-8.3)	13.2 (11.0-14.2)	10.5 (8.4-12.7)
Spring	1990	13.6 (10.8-16.4)	8.0 (7.8-8.1)	9.4 (8.1-10.7)	9.2 (8.9-9.5)
	1991	13.8 (11.1-16.4)	8.4 (7.8-8.7)	10.1 (7.4-10.9)	8.9 (8.3-10.6)
	1992	13.9 (10.5-16.0)	8.0 (7.4-8.7)	8.3 (4.8-11.4)	12.6 (11.0-14.5)
	1993	14.8 (11.4-18.1)	8.1 (7.8-8.4)	10.1 (9.4-11.1)	4.1 (2.9-5.4)
	1994	13.7 (12.6-15.1)	7.4 (7.1-7.6)	8.4 (6.4-9.7)	2.8 (1.3-4.2)
Summer	1990	24.7 (23.8-25.6)	7.9 (7.7-8.1)	7.4 (6.2-8.2)	9.5 (8.6-10.2)
	1991	27.1 (26.0-28.7)	8.1 (7.9-8.2)	6.4 (5.5-7.3)	13.0 (12.5-13.5)
	1992	25.2 (22.9-27.8)	8.0 (7.7-8.5)	7.6 (5.0-10.0)	13.1 (13.0-13.3)
	1993	27.0 (25.8-28.5)	8.1 (7.2-8.5)	6.4 (2.3-8.6)	10.7 (9.2-11.7)
	1994	27.4 (27.1-27.6)	8.2 (7.9-8.4)	7.6 (5.6-9.7)	7.9 (6.6-8.6)

NA = data not available; turbidity and secchi measurements not taken at station MCB4.1E.
Source: MDE electronic database.

Table 3-6 Summary of Water Quality Conditions at MDE Station MCB4.1E (1990-1994)

Sample Season (n = number of data points)	Nitrite (mg/l)	Nitrogen Ammonia (mg/l)	Ortho-Phosphate (mg/l)	Nitrate - Nitrite (mg/l)	Silica (mg/l)	Total Dissolved Phosphorus (mg/l)	Particulate Phosphorous (mg/l)	Total Phosphorous (mg/l)
Fall (n = 8)	0.004 - 0.023	0.003 - 0.075	0.003 - 0.013	0.036 - 0.359	0.22 - 0.90	0.013 - 0.042	0.009 - 0.019	0.023 - 0.050
Winter (n = 10)	0.006 - 0.016	0.003 - 0.081	0.002 - 0.005	0.305 - 0.930	0.10 - 1.41	0.005 - 0.011	0.010 - 0.025	0.016 - 0.033
Spring (n = 11)	0.003 - 0.025	0.003 - 0.203	0.0006 - 0.035	0.220 - 1.010	0.37 - 2.05	0.005 - 0.018	0.001 - 0.030	0.015 - 0.037
Summer (n = 10)	0.0005 - 0.0175	0.003 - 0.047	0.002 - 0.015	0.003 - 0.232	0.42 - 1.31	0.005 - 0.016	0.013 - 0.038	0.018 - 0.052

Sample Season (n = number of data points)	Total Dissolved Nitrogen (mg/l)	Particulate Nitrogen (mg/l)	Particulate Carbon (mg/l)	Organic Carbon Total (mg/l)	Dissolved Organic Carbon (mg/l)	Chlorophyl *a* (μg/l)	Total Suspended Solids (mg/l)
Fall (n = 8)	0.37 - 0.78	0.093 - 0.200	0.51 - 1.17	3.03 - 3.92	2.42 - 3.06	3.44 - 12.11	2.2 - 6.9 surface 6.7 - 24.6 bottom
Winter (n = 10)	0.61 - 1.28	0.116 - 0.304	0.64 - 1.86	3.13 - 4.77	2.20 - 3.37	1.50 - 21.83	3.9 - 7.3 surface 8.1 - 45.4 bottom
Spring (n = 11)	0.62 - 1.27	0.085 - 0.450	0.64 - 3.75	2.73 - 7.81	1.66 - 6.35	1.68 - 42.02	2.8 - 11.8 surface 3.7 - 21.7 bottom
Summer (n = 10)	0.30 - 0.51	0.143 - 0.342	0.78 - 2.03	3.29 - 4.71	2.34 - 3.15	6.57 - 14.06	2.3 - 7.0 surface 3.7 - 9.6 bottom



LABEL	EASTING	NORTHING
BWQ-1	1487000	396330
BWQ-2	1489070	406360
BWQ-3	1489130	397560
BWQ-4	1487450	399980
BWQ-5	1488820	403020
BWQ-6	1489080	405450
BWQ-7	1490070	399690
BWQ-8	1491280	399700
BWQ-9	1494380	394870
BWQ-10	1495330	394870
BWQ-11	1491080	391200
BWQ-12	1492980	391420
BWQ-13	1491060	393630
BWQ-14	1492960	393440

FIGURE 3-12

DRAFT PRELIMINARY

Table 3-7 Mean and Range of *In Situ* Water Quality Variables Measured at Stations in the Poplar Island Archipelago, Fall 1994 to Summer 1995

Season	Depth[a]	Water temp (°C)	pH	DO (mg/l)	Salinity (ppt)	Turbidity (NTU)	Secchi (mm)
Fall	Surface	15.9 (14.9-16.4)	8.5[b] (8.4-8.6)	9.3 (9.0-9.8)	14.4 (14.3-14.5)		
	Mid	15.9 (14.9-16.4)	8.5[b] (8.4-8.6)	9.3 (8.9-9.7)	14.4 (14.3-14.5)	---	---
	Bottom	15.9 (14.9-16.4)	8.5[b] (8.4-8.6)	9.2 (8.8-9.6)	14.4 (14.3-14.5)		
Winter	Surface	3.4 (3.1-4.0)	7.9 (7.8-8.0)	12.2 (11.5-13.0)	13.6 (12.9-14.4)	3.1 (2.1-5.2)	1559 (1200-1800)
	Mid	3.4 (3.1-3.9)	7.9 (7.8-8.0)	12.1 (11.5-13.0)	13.6 (13.0-14.5)		
	Bottom	3.4 (3.2-3.9)	7.9 (7.8-8.0)	12.1 (11.4-13.1)	13.6 (13.0-14.5)		
Spring	Surface	14.0 (12.6-15.2)	8.2 (8.0-8.2)	9.8 (9.3-10.5)	12.4 (12.2-12.7)	2.2 (1.1-4.4)	1873 (1190-3200)
	Mid	13.5 (12.6-14.7)	8.2 (8.0-8.2)	10.1 (9.5-13.9)	12.5 (12.2-12.7)		
	Bottom	13.5 (12.6-14.4)	8.1 (7.9-8.2)	10.2 (9.6-13.9)	12.5 (12.2-12.8)		
Summer	Surface	26.2 (24.7-27.2)	8.4 (8.2-8.6)	7.4 (6.2-8.9)	12.7 (12.4-12.8)	4.3 (2.8-6.3)	1088 (920-1400)
	Mid	25.8 (24.7-27.0)	8.4 (8.2-8.6)	7.3 (6.2-8.8)	12.7 (12.5-12.8)		
	Bottom	25.5 (24.7-26.9)	8.4 (8.2-8.6)	7.2 (5.9-8.7)	12.7 (12.5-12.8)		

[a] Water depth ranged from 1.0m to 3.6m.

[b] Reported as read on instrument, but these values are ~0.2 units high based on past sampling recalibration.

TABLE 3-8 Summary of Existing Water Quality Conditions in Poplar Island Archipelago

Sample Season	Nitrite (mg/l)	Nitrogen Ammonia (mg/l)	Ortho-Phosphate (mg/l)	Nitrate - Nitrite (mg/l)	Silica (mg/l)	Total Dissolved Phosphorous (mg/l)
Fall	0.010 (0.006 - 0.012)	0.032 (0.011 - 0.046)	0.007 (0.004 - 0.015)	0.078 (0.048 - 0.099)	0.76 (0.55 - 0.87)	0.012 (0.008 - 0.014)
Winter	0.005 (0.004 - 0.006)	0.004 (0.003 - 0.021)	0.003 (0.002 - 0.007)	0.326 (0.272 - 0.365)	0.37 (0.24 - 0.56)	0.005 (0.004 - 0.007)
Spring	0.005 (0.005 - 0.006)	0.030 (0.030 - 0.040)	0.006 (0.003 - 0.009)	0.361 (0.339 - 0.381)	0.19 (0.14 - 0.28)	0.009 (0.008 - 0.011)
Summer	0.0008 (0.0005 - 0.0018)	0.013 (0.003 - 0.028)	0.004 (0.003 - 0.004)	0.004 (0.003 - 0.008)	0.92 (0.83 - 1.02)	0.010 (0.009 - 0.010)

Sample Season	Particulate Phosphorous (mg/l)	Total Phosphorous (mg/l)	Total Dissolved Nitrogen (mg/l)	Particulate Nitrogen (mg/l)	Particulate Carbon (mg/l)
Fall	0.016 (0.012 - 0.025)	0.028 (0.022 - 0.038)	0.42 (0.34 - 0.49)	0.190 (0.136 - 0.249)	1.13 (0.75 - 0.1.61)
Winter	0.018 (0.013 - 0.041)	0.024 (0.017 - 0.047)	0.57 (0.52 - 0.65)	0.259 (0.208 - 0.536)	1.64 (1.34 - 3.02)
Spring	0.017 (0.015 - 0.020)	0.026 (0.024 - 0.031)	0.63 (0.62 - 0.65)	0.181 (0.128 - 0.212)	1.13 (0.73 - 1.39)
Summer	0.036 (0.033 - 0.040)	0.046 (0.042 - 0.050)	0.27 (0.26 - 0.29)	0.314 (0.265 - 0.352)	1.87 (1.48 - 2.16)

Sample Season	Organic Carbon Total (mg/l)	Dissolved Organic Carbon (mg/l)	Dissolved Inorganic Carbon (mg/l)	Chlorophyl *a* (μg/l)	Total Suspended Solids (mg/l)
Fall	3.51 (3.01 - 4.06)	2.38 (1.93 - 2.59)	19.4 (11.0 - 26.1)	5.36 (2.41 - 6.99)	19.7 (9.2 - 49.6)
Winter	4.00 (3.62 - 5.46)	2.36 (2.28 - 2.44)	21.0 (16.1 - 26.0)	12.61 (9.29 - 16.1)	28.5 (12.5 - 113.1)
Spring	3.62 (3.17 - 3.89)	2.49 (2.44 - 2.55)	19.7 (17.6 - 25.7)	9.48 (2.58 - 16.4)	21.3 (15.2 - 38.0)
Summer	4.07 (3.69 - 4.45)	2.78 (2.71 - 2.86)	17.4 (16.5 - 17.9)	6.87 (5.17 - 9.50)	38.7 (18.0 - 53.2)

Salinity varied 2 to 3 parts per thousand (ppt) between the four seasonal surveys in the archipelago. Highest salinities occurred during the fall, and lowest salinities occurred during the spring. These are normal salinity patterns that are seen throughout the Chesapeake Bay. During the spring, salinities usually decrease, as a result of increased freshwater runoff and precipitation. Winter and spring of 1994 and 1995 salinities in the archipelago differed by only 1 ppt, the result of a dry spring, with less than average precipitation.

Dissolved oxygen (DO) concentrations in the Poplar Island archipelago varied seasonally, with maximum concentrations recorded during the winter survey and minimum concentrations recorded during the summer. DO concentrations normally vary with seasonal water temperatures: oxygen saturation in water decreases as water temperature increases. Overall, DO concentrations within the water column were uniform, and concentrations fell within the range of values reported for surface waters at MCB4.1E. During the summer survey, DO concentrations were slightly elevated at the surface and indicative of photosynthetic activity in or near the surface strata. Phytoplankton blooms were visually noted throughout much of the area.

The seasonal values of pH are normally influenced by algal photosynthesis and salinity (Molinero and Sohn 1992). Measurements of pH in the archipelago were highest during the summer survey, indicative of normal photosynthetic processes that occur in the water column during this season. Overall, pH values fell within the seasonal ranges reported for MCB4.1E.

Water clarity measured by secchi disk (a black and white disk used to determine turbidity in water) also changed seasonally in the archipelago. Water clarity was greatest during the spring, and the secchi disk could be seen on the bottom in several locations. Normally, water is clearest in the winter, with clarity decreasing as water temperatures and phytoplankton populations increase. Chlorophyll-*a* concentrations indicate that spring sampling within the archipelago occurred before phytoplankton populations had significantly influenced water clarity. Phytoplankton blooms in warmer months can substantially reduce water clarity, which was apparent during the summer survey (EA 1995d). The other significant influence on water clarity in the study area is sediment resuspension.

Turbidity measurements were elevated in the archipelago, probably influenced by island erosion. Total suspended solids were higher in the archipelago than at station MCB4.1E during all seasons. Seasonally, mean values of total suspended solids (TSS) in the archipelago were generally greatest in the summer, but the highest single value (113mg/L) was recorded during the winter survey. Phytoplankton density in the water column likely contributed significantly to the high TSS values measured in the summer survey. Sediment resuspension from prevailing northwest winds during the winter and spring surveys likely contributed to TSS, as visible plumes were seen emanating from the island remnants. These plumes originated from clay layers of the eroding remnants. Turbidity due to resuspension of the silty sands that cover most of the bottom was never significant. Plumes were wind driven and were not widely dispersed, forming long narrow ribbons in the water.

Turbidity and water clarity were also measured at two charted oyster bars (NOB 8-10 and NOB 8-11) adjacent to Poplar Island during the winter, spring, and summer surveys (Figure 3-12). Mean turbidity and secchi measurements are presented in Table 3-9.

Table 3-9 Turbidity and Water Clarity in Proximity to the Poplar Island Project

Oyster Bar	Season	Turbidity (NTU)	Secchi (mm)
NOB 8-10	Fall	--	--
	Winter	2.4	1678
	Spring	1.7	2215
	Summer	3.3	1303
NOB 8-11	Fall	--	--
	Winter	1.8	1903
	Spring	3.5	1705
	Summer	3.0	1360

Turbidity values were greatest during the spring and summer surveys at NOB 8-11 and NOB 8-10, respectively. Secchi disk measurements indicated reduced water clarity at both locations during the summer survey. Summer phytoplankton densities significantly reduce water clarity and increase turbidity measurements. Overall, mean nephalometric turbidity unit (NTU) values at both oyster bars were low compared to values recorded in plumes emanating from the island remnants in the spring survey (EA 1995c); NTU values recorded in plumes ranged from 6.5 to 14.7. The plumes generally emanated from Middle Poplar and Jefferson Island and extended for up to 2 miles south. The plumes generally remained at least 2,000 feet from both oyster bars although certain wind conditions (NW) disperse solids from Jefferson Island over the western portions of NOB 8-11. NTU values at NOB 8-10 and 8-11 are typical of areas that are not subjected to sediment resuspension.

Seasonal patterns of chemical constituents and nutrients at the Poplar Island archipelago were similar to seasonal distributions that occur Baywide. Concentrations of nitrate-nitrite were greatest during the winter and spring and were reduced during summer and fall. Thriving phytoplankton populations typically deplete nitrates in the summer and fall, and precipitation and land discharge replenish nitrate concentrations in the spring (Correll 1987). Total phosphorus concentrations were consistent throughout fall, winter, and spring, with concentrations nearly twice as high during the summer. Sometimes a summer phosphorus peak occurs due to benthic regeneration processes, and similar increases in total phosphorus have been recorded for open Bay areas near Annapolis, Maryland (Correll 1987). Minimum water-column concentrations of silica were reported in the archipelago in the spring (Correll 1987). Silica concentrations were highest during the summer survey, indicating the absence of a summer diatom bloom during the sampling period.

Overall, seasonal water quality conditions in the Poplar Island archipelago were similar to and typical of conditions in shallow, Mesohaline (salinity of approximately 5 to 18 ppt) areas of the Bay. Water quality variables were uniform throughout the water column, with no evidence of the seasonal stratification that often occurs in deeper areas. During all seasons, DO values were greater than 5.0 ppt, the concentration necessary to sustain commercially important fish and shellfish species (Funderburk *et al.* 1991). Although values of turbidity and suspended sediment were elevated in the archipelago, TSS did not exceed levels detrimental to life stages of shellfish and finfish (Funderburk *et al.* 1991).

3.1.5 Sediment Quality

The distribution of sediment types in the Bay is controlled by source materials and by hydrodynamic processes that are responsible for sediment transport and deposition. In addition, bottom erosion can be significant and the Susquehanna River is still an important source of material, especially trace metals. In central portions of the Chesapeake Bay, sand and clay eroded from banks and shorelines are the most abundant sediment types. Sand accumulates in areas of high wave energy such as shoals and exposed shorelines. Silty clay, by contrast, settles in quieter (often deeper) areas with low wave energy. Surface sediments in the Poplar Island archipelago, particularly those subjected to prevailing winds, are influenced by wave action and other erosional forces that have reduced Poplar Island to its current configuration. Sediments in the area of the archipelago range from silts to sand to hard clay.

Sediments in mainstem Chesapeake Bay have low concentrations of metals in contrast to sediments in heavily industrialized western shore tributaries. These may be naturally occuring and not contaminants. Other anthropogenic chemical species such as pesticides could be considered contaminants. Sediment data will be available at the District and will be provided to regulatory agencies. Low levels of contamination are expected in the archipelago, because the mainland near the Poplar Island archipelago is rural, with a small population and no history of significant industrial development.

Since 1984, approximately 135 stations throughout the Bay and its tributaries have been sampled for sediment contaminants by various monitoring programs. Data from Maryland Tributary Sediment Contaminant Monitoring Stations indicates that levels of organics are substantially higher in the Deep Trough region of the mainstem Bay (MCB4.1C) in comparison to organics levels in Eastern Bay (MEE1.1) and in the Choptank Embayment (MEE2.1) (Figure 3-11). In addition, metal analyses reveal that levels of aluminum are elevated at CBWQM stations sampled in mainstem Bay (MCB4.1C, MCB4.1E, and MCB4.2E) and in bays on the Eastern shore (MEE1.1 and MEE2.1). Aluminum poses little risk to aquatic organisms because it is mostly bound within clay particles with little probability of dissolution. Overall, regional information from such studies indicates that sediments within the vicinity of the Poplar Island archipelago are of low risk of contamination (CBP 1995; Rich Eskin 1995).

Baseline seasonal studies conducted in the Poplar Island archipelago (1995a,b,c,d) indicate that the area supports a diverse and productive benthic community. Benthic macroinvertebrate assemblages are good indicators of environmental conditions and are often used to describe local ecological status and trends in a wide range of aquatic environments (Dauer *et al.* 1988, 1989; Holland *et al.* 1988, 1989). Sediment contamination poses risks to benthic macroinvertebrates and, therefore, significant levels of contamination are reflected in the benthic community structure when contaminants are present. The productive and diverse benthic community within the Poplar Island archipelago could be indicative of high sediment quality in the area, and no contaminants are present.

3.1.6 Aquatic Resources

3.1.6.a Phytoplankton and Zooplankton. Phytoplankton serve as the base of the aquatic food chain, produce life-sustaining oxygen for aquatic organisms, and assimilate nutrients (nitrogen, phosphorus, and silicon) that flow into the Bay. Light, temperature, nutrients, and zooplankton abundance regulate the distribution of phytoplankton in the Chesapeake Bay (Lippson 1973). Maximum phytoplankton productivity for the Chesapeake Bay generally occurs in the vicinity of the Bay Bridge, where water clarity, nutrient concentrations, and mixing in the water column create optimal conditions (Sellner 1987). Poplar Island is approximately 17 miles south of the Bay Bridge.

Diatoms, dinoflagellates, golden brown algae, green algae, and blue-green algae represent dominant major phytoplankton taxonomic groups found within the Chesapeake estuary. Maximal phytoplankton biomass in the Chesapeake Bay coincides with spring diatom blooms. Primary production by phytoplankton peaks in the spring, (March through May) with a secondary peak during the summer (Sellner 1987). By late summer, dinoflagellates represent a large portion of phytoplankton densities, and in the fall, diatom densities exhibit a slight increase in Mesohaline areas. Overall densities of all species are minimal during the winter months, with the exception of a periodic bloom of diatoms and dinoflagellates (Sellner 1987).

A standing crop (biomass) of phytoplankton is measured indirectly as concentrations of chlorophyll-*a*. Chlorophyll-a has been measured seasonally during 1994 and 1995 in the Poplar Island study area as part of the water quality monitoring program. Mean concentrations of Chlorophyll-*a* (Table 3-8) fell within the range of values observed in the upper 17 feet of the water column at station MCB4.1E (in the mouth of the Choptank River) during the past 5 years (Table 3-6). Chlorophyll-*a* values recorded in the archipelago indicated two biomass peaks, one during the winter survey and a second during the summer. The winter peak may have been indicative of an early spring bloom because the samples were collected in early March.

Zooplankton provide an important pathway by which phytoplankton and bacterial biomass move up through the food web to the higher trophic levels. Grazing by zooplankton regulates phytoplankton and bacteria populations, and excretion by zooplankton transports nutrients to the benthos (Brownlee and Jacobs 1987).

Calanoid copepods dominate zooplankton collections in the Maryland and Virginia portions of the Chesapeake Bay (Brownlee and Jacobs 1987, Lippson 1973). Species distributions vary seasonally and by salinity. In Mesohaline salinities (5 to 18 ppt), *Acartia* spp. dominate zooplankton communities in the summer and fall, *Eurytemora affinis* predominate in the winter months, and *E. affinis* and *Acartia* spp. are codominants in the spring (Brownlee and Jacobs 1987, Lippson 1973). In addition to calanoid copepods, polychaete larvae and barnacle nauplii have been collected in winter and spring Mesohaline collections, respectively (Brownlee and Jacobs 1987, Lippson 1973).

During the summer, comb jellies (ctenophores), such as the sea walnut (*Mnemenopsis leodyi*), are often abundant in the plankton. These organisms were observed in the water column at the Poplar Island archipelago during the summer survey (EA 1995d). Grazing by ctenophores substantially reduces copepod densities in the warmer months (Feigenbawn and Kelly 1984). Copepods are eaten by virtually all larger organisms in the bay except shellfish (Lippson 1973), and some fish species need high copepod densities to survive early stages of development (Chesney 1989).

The American oyster, *Crassostrea virginica*, the soft-shell clam, *Mya arenaria*, and the razor clam, *Tagelus sp.*, represent three commercially important bivalve species, whose planktonic larvae are distributed in Mesohaline areas such as the Poplar Island archipelago. Oysters spawn when water temperatures reach 18-20°C, which typically occurs in May/June and again in mid-October in the vicinity of Poplar Island. Spawning may occur more than once per season, and larvae remain planktonic for 2 to 3 weeks (depending on ambient temperatures) before settling (Kennedy 1991). Soft-shell clams spawn twice a year: mid- to late fall and late spring, when temperatures reach 12-15°C. Soft-clam larvae remain in the plankton for approximately 1 to 3 weeks, depending on temperatures (Baker and Mann 1991). These and other bivalve larvae contribute significantly to the available food at this trophic level during periods of abundances and are heavily preyed upon by many estuarine inhabitants (Kennedy 1991, Baker and Mann 1991).

Zooplankton were qualitatively assessed during ichthyoplankton surveys of the archipelago conducted during 1994 and 1995 (EA 1995a,b,c,d); the results are summarized in Table 3-10. Copepods dominated the plankton during all seasons, although amphipods were abundant in winter and spring collections. Hydromedusae were collected during all seasons, but ctenophores were only taken in abundance in the summer. Isopods and crab larvae were also collected in all seasons but were more abundant in summer. All other zooplankton occurred seasonally. The zooplankton noted within the study area are typical of this region of the Bay and are not indicative of unique habitats or environmental perturbations.

3.1.6.b Fish. Historically, the Chesapeake Bay has been among the most productive estuaries in the world for fish and shellfish, supporting commercial fisheries for as many as 40 species throughout Maryland and Virginia. In the past two decades, populations of some fish species (e.g. American shad and river herring) have declined significantly (Richkus *et al.* 1992), whereas other species such as striped bass are showing signs of recovery after years of record low abundances (EPA 1995).

The Bay supports over 100 species of fish for at least some stage of their lifecycles, and these are distributed primarily based on their tolerance to salinity, available habitat, and annual migratory cycles (Lippson *et al.* 1979; Lippson and Lippson 1984). Poplar Island is located in an area classified as Mesohaline. Salinities around the archipelago vary from 10 to 15 ppt (Section 3.1.4). Fish species that occur in the mainstem Chesapeake Bay can be divided into several classifications, based on their use of an area: resident species that live out their entire lifecycle in an area; anadromous species that spend much of their adult lives at sea but utilize

Table 3-10 Zooplankton Observed During Ichthyoplankton Surveys of Poplar Island 1994-1995

Taxonomic Groups	Fall 1994	Winter 1995	Spring 1995	Summer 1995
Ctenophores and Hydromedusae (Jellyfish)	C	P	C	C
Copepods	C	A	A	A
Amphipods		A	A	P
Isopods	P	P	P	P
Decapod zoea (Crab larve)	P	P	P	A
Polychaetes (segmented worms)			P	
Chaetognathes (Arrow worms)	C			
Mysids (Opossum shrimps)	P	P		
Bivalve (Clams)		C		
Hirudinea (Leeches)			P	
Diptera (Flies)			P	
Coleoptera (Beetles, Weevils)			P	
Palaemonetes (Grass shrimp)				C

P = present (1-20 individuals); C = common (20-200 individuals); A = abundant (200+ individuals) the estuary as juveniles or during migrations; freshwater species that occur only occasionally within this zone, being restricted by salinity; and marine species that spend most of their lives in higher salinities but utilize Mesohaline areas as juveniles or for spawning. This latter group includes both species that regularly (seasonally) utilize the area for some period of their life cycles as well as many that are only occasional components of the fish community at this salinity.

An inventory of fishes known to occur in middle Mesohaline salinity regimes (10 to 15 ppt) in the Bay from the Bay Bridge to the Potomac River was derived from a variety of sources and is included in Table 3-11. Table 3-12 provides a synopsis of general distribution and life history information for these species. Seventy species are known to spend at least some portion of their lifecycle in this salinity regime.

General distribution information does not completely address habitat preferences among species known to occur within a salinity regime. The archipelago formed by the four remnants, Jefferson Island and Coaches Island, represents an area of relatively shallow water (less than 17 feet) that is surrounded by areas of much deeper water (greater than 33 feet). Many of the resident species in this salinity regime are relatively non-mobile and habitat specific. For example, blennies, gobies, and skilletfish prefer shallow areas with abundant cover like that expected in an oyster reef; they are known to remain in specific areas (Schwartz 1961) particularly during the breeding season (Lippson *et al.* 1979). Some species that occasionally occur in shallow areas are more typically found in deeper areas (e.g., sharks). Species more common to fresh water (chain pickerel, gizzard shad) may occur in Mesohaline portions of rivers, but are less likely to occur in offshore areas such as Poplar Island. Listing only those most likely to occur in shallow open areas in this region of the Bay, the estimated number of fish species that could potentially occur within the archipelago is approximately 50.

To identify the fish species actually utilizing the archipelago, a four-season sampling program was conducted from October 1994 through July 1995 (EA 1995a,b,c,d). Collections of shore-zone fishes were made at two stations on the island remnants in the Fall of 1994, plus two additional stations in the other seasons (Figure 3-14). Epibenthic fishes were collected by otter trawl, and ichthyoplankton were sampled with paired plankton nets (mounted on a sled) from two offshore stations in the fall and four stations in each of the other seasons (Figure 3-14). Pelagic fishes were sampled using experimental gillnets set overnight at three locations during the winter, spring, and summer surveys. Summaries of seine, otter trawl, and gillnet collections are presented in Table 3-13. Individual catches by station are detailed in the quarterly data reports (EA 1995a,b,c,d) and included in Appendix B.

Fish collections yielded 20 species representing 14 families (Table 3-13). The life stages of the species collected are indicated on Table 3-12. The most abundant families (in terms of numbers of species) include herring (4 species), drums (3 species), and anchovies (2 species). Shore-zone (seine) collections yielded the most abundant and diverse catches overall, particularly in the summer (Table 3-13). Resident fishes (particularly Atlantic silverside, *Menidia menidia*) dominated shore-zone collections in all seasons, although the summer shore-zone community

Table 3-11 **Scientific and Common Names of Fishes That Occur in Mesohaline Areas of Chesapeake Bay**

Common Name	Scientific Name
Family **Species**	**Family** **Species**
Requiem sharks	Carcharhinidae
Bull shark	*Carcharhinus leucas*
Sandbar shark	*Carcharhinus plumbeus*
Eagle rays	Myliobatidae
Cownose ray	*Rhinoptera bonasus*
Sturgeons	Acipenseridae
Shortnose sturgeon (a)	*Acipenser brevirostrum*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Freshwater eels	Anguillidae
American eel	*Anguilla rostrata*
Herrings	Clupeidae
Blueback herring	*Alosa aestivalis*
Hickory shad	*Alosa mediocris*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
Atlantic menhaden	*Brevoortia tyrannus*
Atlantic herring	*Clupea harengus*
Gizzard shad	*Dorosoma cepedianum*
Threadfin shad	*Dorosoma petenense*
Anchovies	Engraulidae
Striped anchovy	*Anchoa hepsetus*
Bay anchovy	*Anchoa mitchilli*
Pikes	Esocidae
Chain pickerel	*Esox niger*
Lizardfishes	Synodontidae
Inshore lizardfish	*Synodus foetens*
Toadfishes	Batrachoidae
Oyster toadfish	*Opsanus tau*
Clingfishes	Gobiesocidae
Skilletfish	*Gobiesox strumosus*
Flyingfishes	Exocoetidae
Halfbeak	*Hyporhamphus unifasciatus*
Needlefishes	Belonidae
Atlantic needlefish	*Stongylura marina*
Killifishes	Cyprinodontidae
Sheepshead minnow	*Cyprinodon variegatus*
Banded killifish	*Fundulus diaphanus*
Mummichog	*Fundulus heteroclitus*
Striped killifish	*Fundulus majalis*
Rainwater killifish	*Lucania parva*

Table 3-11 (continued)

Common Name	Scientific Name
Family **Species**	**Family** **Species**
Silversides	Atherinidae
Rough silverside	*Membras martinica*
Inland silverside	*Menidia beryllina*
Atlantic silverside	*Menidia menidia*
Sticklebacks	Gasterosteidae
Fourspine stickleback	*Apeltes quadracus*
Threespine stickleback	*Gasterosteus aculeatus*
Pipefish and seahorses	Syngnathidae
Lined seahorse	*Hippocampus erectus*
Dusky pipefish	*Syngnathus floridae*
Northern pipefish	*Syngnathus fuscus*
Searobins	Triglidae
Northern searobin	*Prionotus carolinus*
Temperate basses	Percichthyidae
White perch	*Morone americana*
Striped bass	*Morone saxatilis*
Sea basses	Serranidae
Black sea bass	*Centropristis striata*
Perches	Percidae
Yellow perch	*Perca flavescens*
Bluefishes	Pomatomidae
Bluefish	*Pomatomus saltatrix*
Cobias	Rachycentridae
Cobia	*Rachycentron canadum*
Jacks	Carangidae
Blue runner	*Caranx crysops*
Crevalle jack	*Caranx hippos*
Lookdown	*Selene vomer*
Florida pompano	*Trachinotus carolinus*
Porgies	Sparidae
Scup	*Stenotomus chrysops*
Drums	Sciaenidae
Silver perch	*Bairdiella chrysoura*
Spotted seatrout	*Cynoscion nebulosus*
Weakfish	*Cynoscion regalis*
Spot	*Leiostomus xanthurus*
Atlantic croaker	*Micropogonias undulatus*
Black drum	*Pogonias cromis*
Red drum	*Sciaenops ocellatus*

Table 3-11 (continued)

Common Name	Scientific Name
Family	**Family**
Species	**Species**
Mullets	Mugilidae
Striped mullet	*Mugil cephalus*
White mullet	*Mugil curema*
Stargazers	Uranoscopidae
Northern stargazer	*Astroscopus guttatus*
Combtooth blennies	Blenniidae
Striped blenny	*Chasmodes bosquianus*
Feather blenny	*Hypsoblennius hentzi*
Gobies	Gobiidae
Darter goby	*Gobionellus bolesoma*
Naked goby	*Gobiosoma bosci*
Seaboard goby	*Gobiosoma ginsburgi*
Green goby	*Microgobius thalassinus*
Mackerels	Scombridae
Spanish mackerel	*Scomberomorus maculatus*
Lefteye flounders	Bothidae
Summer flounder	*Paralichthys dentatus*
Windowpane	*Scophthalmus aquosus*
Righteye flounders	Pleuronectidae
Winter flounder	*Pleuronectes americanus*
Soles	Soleidae
Hogchoker	*Trinectes maculatus*
Tonguefishes	Cynoglossidae
Blackcheek tonguefish	*Symphurus plagiusa*
Puffers	Tetraodontidae
Northern puffer	*Sphoeroides maculatus*
Porcupinefishes	Diodontidae
Striped burrfish	*Chilomycterus schoepfi*

Sources: Hildebrand and Shroeder 1928; Lippson and Lippson 1984; Lippson 1973; Setzler-Hamilton 1987; White 1989. Dovel 1971; Funderburk *et al.* 1991; Lippson and Moran 1975; MD DNR Juvenile index and commercial landings databases; John Gill, pers. comm., and EPA EMAP database.

(a) NMFS acknowledges the protected status of this species but does not consider it common in the project area and doesn't believe that it will be adversely affected by project operations.

Table 3-12 **Lifestages of Fish Species Commonly Found in Mesohaline Areas of Chesapeake Bay With Reference to Those Collected in 1994-1995 Surveys of the Poplar Island Archipelago**

Species Common Name	General Distribution[a]						Collected or Observed			
	Resident	Seasonal				Occasional				
		F	W	Sp	Su		F	W	Sp	Su
Bull shark						J, A				
Sandbar shark						J				
Cownose ray					J, A					A
Shortnose sturgeon						J, A				
American eel				L, J		A				
Blueback herring		J		J, A	J, A			J		J
Hickory shad						J, A				
Alewife		J		J, A	J, A			A	J,A	J, A
American shad			A	J, A	J, A					
Atlantic menhaden		A, L		E, L, J	J, A			J	E,A	J, A
Atlantic herring					J, A			A	A	
Gizzard shad						J, A				
Threadfin shad						J, A				
Striped anchovy						J, A				J
Bay anchovy		E,L J,A	J,A	E,L J,A	E,L,J, A		A	J	E,J	J, A
Chain pickerel						J, A				
Inshore lizardfish						J, A				
Oyster toadfish	A	L, J			E,L,J					J
Skilletfish	A	E,L,J		E,L J	E,L J					J
Halfbeak						J, A				
Atlantic needlefish		J,A		E,A	E,L J, A					A
Sheepshead minnow	A	J		E,L	E,L J					
Banded killifish						J, A				
Mummichog	A	J		E	E,J					
Striped killifish	A	J		E,L	E,L J		A		J,A	A
Rainwater killifish	A	J		E,L	E,L J					

Resident = non-mobile, habitat specific; Seasonal = pelagic migratory; Occasional = limited by salinity or habitat, occurrence unlikely. Seasons: F = Fall; W = Winter; Sp = Spring; Su = Summer. Lifestages: E = Egg; L = Larvae; J = Juvenile; A = Adult.

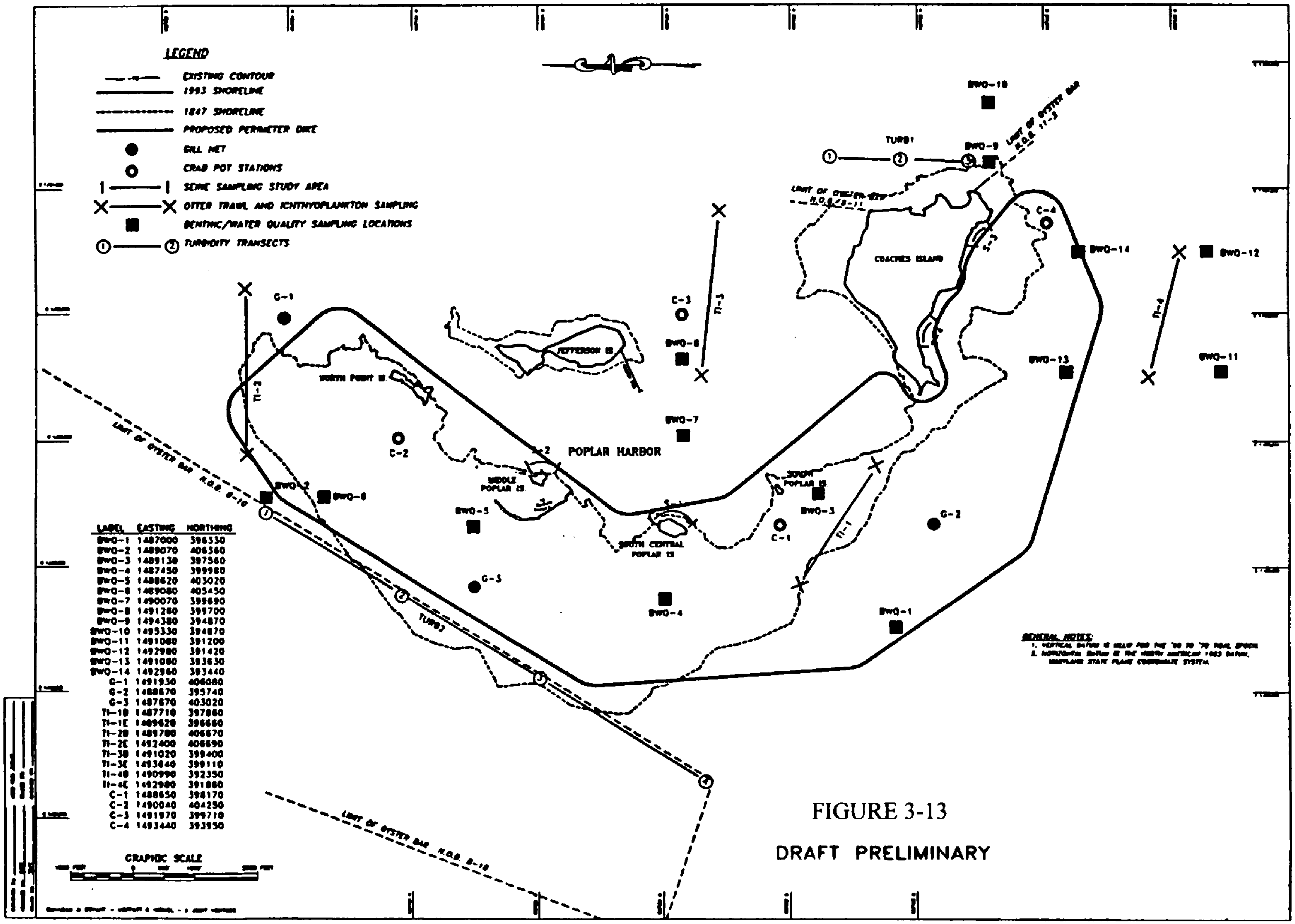
Table 3-12 **(continued)**

Species Common Name	General Distribution[a]						Collected or Observed			
	Resident	Seasonal				Occasional				
		F	W	Sp	Su		F	W	Sp	Su
Rough silverside						J,A				
Inland silverside	A	L,J	J,A	E,LJ	E,L J	J,A				
Atlantic silverside	A	L,J	J,A	E,L J	E,L J		A	A	E,L, J,A	J, A
Fourspine stickleback	A			E,L J	J					
Threespine stickleback	A			E,L J	J					
Lined seahorse	A				E,L J				A	
Dusky pipefish						J, A				
Northern pipefish	A	J		E,L	E,L J				J	J
Northern searobin						J, A				A
White perch						J, A				
Striped bass	J	A		A	A		J	J	J,A	J, A
Black sea bass						J, A				
Yellow perch						A				
Bluefish		J,A		J,A	J,A					J
Cobia						J, A				
Blue runner						J, A				
Crevalle jack						J, A				
Lookdown						J, A				
Florida pompano						J, A				
Scup						J, A				A
Silver perch						J, A				
Spotted seatrout		J		J	J, A					
Weakfish		J		L,J	L, J A					J, A
Spot		J		J	J, A		J		J	J, A
Atlantic croaker		J		J	J, A					A
Black drum		J			J, A					
Red drum		J								
Striped mullet						J, A				
White mullet						J, A				

Table 3-12 **(continued)**

Species Common Name	General Distribution[a]						Collected or Observed			
	Resident	Seasonal				Occasional				
		F	W	Sp	Su		F	W	Sp	Su
Northern stargazer						A				
Striped blenny	A	J		E,L	E,L J					
Feather blenny	A	J		E,L	E,L J					L,J
Darter goby						J, A				
Naked goby	A	E,LJ		E,L	E,L J					L
Seaboard goby						J, A				
Green goby	A	L,J			E,L J					
Spanish mackerel						J, A				
Harvestfish						J, A				
Butterfish						J, A				
Summer flounder		J, A		J, A	J, A					J,A
Windowpane						J, A				
Winter flounder		A	A	L, J	J			L		J
Hogchoker	A	J			E,L J					E
Blackcheek tonguefish						J, A				
Northern puffer						J, A				
Striped burrfish						J, A				

Sources: Hildebrand and Shroeder 1928; Lippson ans Lippson 1984; Lippson 1973; Setzler-Hamilton 1987; White 1989. Dovel 1971; Funderburk *et al.* 1991; Lippson and Moran 1975; MD DNR Juvenile index and commercial landings databases, John Gill, pers. Comm., and EPA EMAP database.



LABEL	EASTING	NORTHING
BWQ-1	1487000	398330
BWQ-2	1489070	406380
BWQ-3	1489130	397560
BWQ-4	1487450	399980
BWQ-5	1488620	403020
BWQ-6	1489080	405450
BWQ-7	1490070	399690
BWQ-8	1491260	399700
BWQ-9	1494380	394870
BWQ-10	1495330	394870
BWQ-11	1491080	391200
BWQ-12	1492980	391420
BWQ-13	1491080	393630
BWQ-14	1492960	393440
G-1	1491930	406080
G-2	1488870	395740
G-3	1487670	403020
TI-1B	1487710	397880
TI-1E	1489620	396660
TI-2B	1489780	406670
TI-2E	1492400	406690
TI-3B	1491020	399400
TI-3E	1493640	399110
TI-4B	1490990	392350
TI-4E	1492980	391880
C-1	1488650	398170
C-2	1490040	404250
C-3	1491970	399710
C-4	1493440	393950

FIGURE 3-13

DRAFT PRELIMINARY

Table 3-13 Summary of Fish Collections in the Poplar Island Study Area, October 1994 Through July 1995

Species	Seine[e]				Gill nets[f]		
	Fall 1994	Winter 1995	Spring 1995	Summer 1995	Winter 1995 (58.30 hr)	Spring 1995 (48:40)	Summer 1995 (53:45)
Blueback herring		1		2			
Alewife				3	1	6	
Atlantic menhaden				5		149	115
Atlantic herring					4	1	
Striped anchovy				2			
Bay anchovy	119			17			
Oyster toadfish				6			
Atlantic needlefish				3			
Striped killifish	6		14	8			
Atlantic silverside	38	14	365	10,514			
Northern pipefish			2	1			
Northern searobin							1
Striped bass				67	1	8	25
Bluefish							3
Scup							1
Weakfish							5
Spot	2					2	85
Atlantic croaker							18
Summer flounder							1
Winter flounder							
Blue crab	4			6		2	2

(a) 2 trawl stations in fall, 4 stations in each other season; 10 minutes of effort at each station per season (covering approximately 600 total meters of bottom).
(b) 2 crabpot stations in fall, 4 in each other season traps; total seasonal trap hours in parentheses.
(c) 2 seine station in fall, 4 in other seasons; 2 hauls covering approximately 60 m of beach at each station during each season.
(d) Gillnetting only done in three seasons; one experimental gillnet set at each of three sites per season; set time in parentheses.

TABLE 3-13 (continued)

Species	Otter trawl[a]				Crab pots[b]			
	Fall 1994	Winter 1995	Spring 1995	Summer 1995	Fall 1994 (192 hr)	Winter 1995 (384 hr)	Spring 1995 (384 hr)	Summer 1995 (336 hr)
Blueback herring								
Alewife								
Atlantic menhaden								
Atlantic herring								
Striped anchovy				2				
Bay anchovy		1	3	711				
Oyster toadfish								
Atlantic needlefish								
Striped killifish								
Atlantic silverside				4				
Northern pipefish			2	1				
Northern searobin								
Striped bass	1							
Bluefish								
Scup								
Weakfish								
Spot								
Atlantic croaker								
Summer flounder				1				
Winter flounder				13				
Blue crab	5		2	17	7			19

also included the young of several seasonal/anadromous species. Gillnet collections targeted the transient fishes that were moving in and out of the archipelago (presumably to feed). Atlantic menhaden *(Brevoortia tyrranus)* dominated these collections in spring and summer, although summer collections also yielded a variety of commercially/recreationally important species: striped bass (*Morone saxatius*), bluefish (*Pomatomus saltatrix*), weakfish (*Cyoscion regalis*), croaker (*Micropogonias undulatus*), and flounder (*Paralichthys dentatus*). Bay anchovy (*Anchoa mitchelli*) was the most dominant species collected in the trawls. The only other recent surveys identified for the region were the Maryland juvenile finfish survey and the EPA Environmental Monitoring and Assessment Program (EMAP) collections. Although the juvenile surveys are conducted in more riverine areas (e.g., Cambridge), the three closest survey points reported catches very similar in abundance and diversity to the shore-zone collection at Poplar Island. The EPA EMAP program spanned from 1990 to 1994 and involved annual collections at random locations throughout the Bay. A review of the collections from stations from the Bay Bridge to the Potomac River (including Eastern Bay and the Choptank confluence) revealed similar species to those collected during existing conditions surveys at Poplar Island. One notable difference is that harvestfish (*Peprilus alepidotus*) were taken at most locations. This is a fish that is expected to occur in the region, but was not collected during existing conditions surveys, although the larger trawls used by the EPA might be more efficient at capturing this species.

In addition to the fishes collected, two species were observed within the study area but were not caught in any gear. Cownosed rays (*Rhinoptera bonasus*) were observed around the archipelago in abundance, particularly in June. A lined seahorse (*Hippocampus erectus*) was captured during the early summer SAV survey (Section 3.1.6.e). Some species were collected only during their early life history. Summaries of ichthyoplankton collections are presented in Table 3-14 with station-specific collections detailed in Appendix B and the quarterly data reports (EA 1995a,b,c,d). Hogchoker (*Trinectes maculatus*) , feather blenny (*Hysobennius hentzi*), naked goby (*Gobiasoma bosci*), and skilletfish (*Gobiesox strumousus*), all resident species, were collected only as eggs or larvae. With the exception of hogchokers, the adults of these species are associated with shells or other cover items and are not easily captured in conventional survey gears (Schwartz 1961).

Ichthyoplankton densities were notably low in all seasons. Many of the resident species attach their eggs to the substrate or cover items, but the larvae should have been evident in the plankton. Since sampling was performed quarterly, peak planktonic abundance for some species may not have been observed. Other factors that may have influenced ichthyoplankton sampling efficiency were the diurnal (day/night) and tidal timing of collections. Some species are collected at higher abundances during periods of high tidal current (on a spring tide) or are most abundant in night collections. Although ichthyoplankton collections were made on flood tides (near high water), they were not made at night or coordinated with the highest tides of the month. This may have influenced ichthyoplankton abundances and diversities. Winter flounder (*Pleuronectes americanus*) were taken in the plankton as larvae in the winter, then as young in the summer, indicating that much of their development may have taken place near the study area. Multiple lifestages of Atlantic menhaden were also collected in various gears throughout the study period but reflect two different spawning periods (early fall and spring).

Table 3-14 Ichthyoplankton Collected During Fisheries Studies near Poplar Island, July 1995

Species and Lifestage	Fall 1994	Winter 1995	Spring 1995	Summer 1995
Atlantic menhaden juveniles (*Brevoortia tyrranus*)		2		
Atlantic menhaden egg (*Brevoortia tyrannus*)			10	
Bay anchovy egg (*Anchoa mitchelli*)			1	
Bay anchovy juvenile (*Anchoa mitchelli*)				1
Silverside species egg (*Menidia* spp.)			1	
Atlantic silverside metalarvae (*Menidia menidia*)			1	
Skilletfish juvenile (*Gobiesox strumosus*)				1
Northern pipefish juvenile (*Syngnathus fuscus*)				3
Feather blenny mesolarvae (*Hypsoblennius hentzi*)				1
Feather blenny metalarvae				3
Feather blenny juvenile				1
Naked goby mesolarvae (*Gobiosoma bosci*)				3
Winter flounder mesolarvae (*Pleuronectes americanus*)				
Hogchoker egg (*Trinectes marculatus*)				7
Undetermined fish egg			3	
Undetermined fish larvae			1	

All of the fish species collected are common in the region (Table 3-12) and none is indicative of unique habitat. From the composition of the observed fish community, several inferences can be made about the quality of fish habitat and availability of food within the study area. Pipefish (Syngnatus spp.) and seahorses are generally associated with weedbeds or other plant cover (e.g., macro algae) (Lippson and Lippson 1984, Schwartz 1961). Although little evidence of SAV was found within the study area, some algae was found during the spring and summer surveys and may be providing needed cover in the absence of SAV. The presence of cownosed rays in the high abundances noted in the early summer implies that food availability, particularly soft clam abundance (a preferred food item), is probably good within the study area. The occurrence of striped bass of various life stages throughout the year reflects the cover available within the archipelago. The numerous snags along all of the island remnants, created by fallen trees and erosion, are among the best available habitat in the area for large fishes and have been noted as an important refuge area for both adult and juvenile striped bass (Garry 1995). Bay anchovy, Atlantic menhaden, river herring, and juveniles of species such as striped bass and silversides feed predominantly on plankton (Myatt and Myatt 1990, Houde and Zastrow 1991, Setzler-Hamilton and Hall 1991). The abundance of these fish species within the study area during various seasons is very likely a measure of the availability of zooplankton. Similarly, many of the small resident species (e.g., blennies, gobies) and many of the seasonal species (e.g. spot, winter flounder, scup) feed on epibenthic invertebrates such as mysids and sand shrimp (Myatt and Myatt 1990, Homer and Mihursky 1991). These invertebrates were noted in abundance in bottom trawls, particularly in the summer. Species that are generally common in saltmarshes with muddy substrates (e.g. mummichogs, sheepshead minnow) were conspicuously absent from fish collections, although the available saltmarsh habitats within the proposed alignment were sampled.

The Poplar Island archipelago and nearby waters are meeting the food and physical habitat needs of many fish species in the region, supporting a relatively diverse fish community (most notably in the summer). The absence or low abundance of regionally common resident species from fisheries collections (e.g., mummichogs, young gobies) indicate that some fish habitats such as vegetated wetlands and SAV may be scarce within the study area. The depauperate catches in trawl collections throughout the year would tend to support this assumption. Abundance of preferred forage species such as silversides will attract larger seasonally abundant predators to the archipelago.

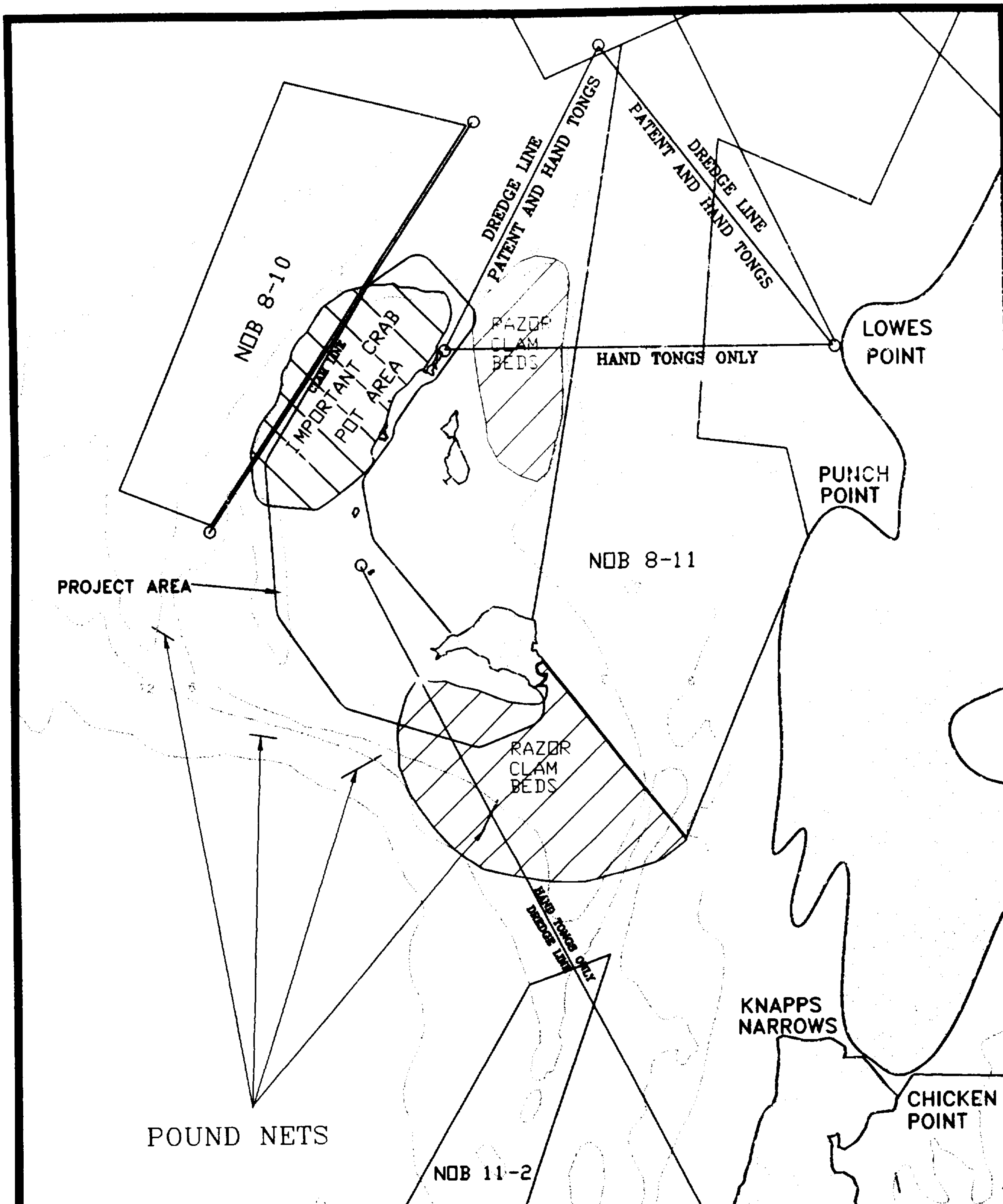
NMFS and DNR identified special concerns regarding habitat preservation for two organisms, Horseshoe crab (*Limulus polyphemus*) and Northern diamondback terrapin (*Malaclemys terrapin terrapin*), that may utilize the remaining islands of the Poplar Island archipelago (Butowski 1995; Carter 1995). Horseshoe crabs have been reported spawning on at least 30 beaches in the Eastern Bay region including Poplar Island (O'Connell 1995). Horseshoe crabs were collected in archipelago waters during the spring survey; however no spawning activity was observed (EA 1995c). Horseshoe crabs require sand beaches for spawning, although some spawning on mud/sand beaches has been reported in the Eastern Bay region. Suitable spawning habitat for this species occurs on all islands of the archipelago but specifically on the south and northwest sides of Coaches Island, the east side of South Central Poplar, and most shores of Jefferson Island. No diamondback terrapins were observed during seasonal surveys (EA 1995a,b,c,d). Terrapins utilize coastal marshes, tidal flats, coves, estuaries, inner edges of barrier beaches or any unpolluted body of salt or brackish water (Conant 1986), and sand is preferred for nesting

(White 1989). All of these habitat types are available within the Poplar Island archipelago both inside and outside of the proposed alignment.

3.1.6.c Commercially Important Species. Five species of fish commonly landed commercially in the area were collected during the seasonal surveys. These include bluefish, summer flounder, Atlantic menhaden, striped bass, and weakfish. Additionally, three species that comprise one commercially important group (herring) were collected: alewife, blueback herring, and Atlantic herring. Although the river herrings are generally targeted for baitfish collections, watermen tend to record all landings (except menhaden) as "herring" regardless of species (Klauda *et al* 1991). Of the commercially important species, striped bass and Atlantic menhaden are the most important in this region of the Bay, both in terms of poundage and dollar value (Section 3.3). Seasonal collections indicate that both of these species utilize the study area for more than one lifestage and season (Table 3-12). Striped bass, bluefish, and weakfish were also the most frequently landed fish on charter cruises from the western half of the Bay from Kent Point to the Choptank River (Nick Carter 1995).

Four invertebrate species of commercial importance occur in abundance within the study area and nearby waters: soft shell clams, oysters, blue crabs, and razor clams. Razor clams are harvested from areas south of Coaches Island and off the north shore of Jefferson Island (Figure 3-14) and are used only for bait (Nichols, 1995). Young razor clams were collected during benthic surveys in the waters surrounding the archipelago, indicating recent recruitment. Peak densities of soft shell clams along the eastern shore of the Chesapeake are found from the Eastern Bay to Pocomoke Sound, particularly at depths of less than 17 feet (Baker and Mann 1991). Anecdotal information of soft clam harvests from the study area indicate that the species has been abundant in the last several decades, with harvests reaching up to 1,000 bushels per acre per recruitment (probably over a 3-year period) (Nichols, 1995). There are some indications that soft clam densities may currently be depressed near the study area (Nichols, 1995). Aside from being among the most important commercial landing in the Talbot County area (Section 3.3), soft clams contribute significantly to the food chain in Mesohaline areas. Soft clam larvae can be abundant in the spring zooplankton, but recruitments are often poor due to predation pressures (Baker and Mann 1991). Juvenile and adult clams are also important food items for a variety of fish and invertebrates (Baker and Mann 1992). Only young soft-shell clams were collected during benthic surveys within the proposed dike alignment. The gear being utilized for benthic collections was insufficient to collect adults, but the occurrence of juveniles indicates that active recruitment is occurring within the proposed dike alignment.

For hundreds of years, eastern oysters were among the most abundant bivalves and the most commercially important fisheries resources in the Bay (Richkus *et al.* 1992). Harvests throughout the Bay have been declining for decades for a variety of reasons, leading to a near collapse of the industry in recent years (CBP 1995). Several oyster bars are in immediate proximity to the study area (Figure 3-14) although the one to the east side of Coaches Island NOB 8-11, which is 200 feet from the western toe of the proposed dike, is currently not very productive (Nichols, 1995). Viable oysters were found in the shore-zone along the south shore of Coaches Island. This was the only confirmed occurrence within the proposed dike alignment, although oyster shells were brought up at several benthic and trawl locations adjacent to NOB 8-10. Like soft shell clams, larval oysters contribute to the



Based on NMFS database and watermens input from public meeting

C:\HMI\NC\DRWG\040793.DWG

MARYLAND ENVIRONMENTAL SERVICE

FIGURE 3-14
COMMERCIAL FISHING AREAS IN PROXIMITY TO PROJECT AREA

zooplankton and can be heavily preyed upon in some areas. Oysters also provide the only available hard substrate in many areas of the Bay, and oyster bars provide physical habitat for a wide variety of Bay species (Kennedy 1991).

Since the decline of oyster abundances in the Bay, blue crab harvests have become the most valuable fishery in the region (Richkus 1992). Blue crabs utilize nearly every habitat type in the Bay during some stage of their lifecycles. The area around Poplar Island would typically be utilized by juveniles and adults during the warmer months, when crabs tend to be in the shallows. Shallow water areas, particularly those with SAV or other suitable cover, are important refuges for older juveniles and soft crabs (Van Heukelem 1991). In addition to the incidental catches in seines, trawls, and gillnets, crab pots were fished at two stations within the 1847 footprint alignment in the fall and at these and two others in winter, spring, and summer (Figure 3-13). Two crab pots were set at each station for a minimum of 48 hours per season. During the fall and summer surveys, blue crabs were only collected in crab pots and in the shore-zone, but were collected by trawl and gillnet in all but the winter survey. The overall catches within the study area (even in the summer) were lower than expected even for an area utilized extensively by commercial crabbers. The reasons for the seemingly low catches are unknown. Plausible explanations include a current Baywide slump in crab populations (Buck 1995; Wheeler 1995), a large mesh size that precludes capture of juveniles, or sampling traps being emptied.

3.1.6.d Benthic Invertebrates. Benthic invertebrate communities are some of the most important components of the Chesapeake Bay estuarine ecosystem. They are the major trophic link between primary producers (i.e., phytoplankton and plants) and higher trophic levels including fish, birds, and other wildlife (Carriker 1967; Virnstein 1977; Holland *et al.* 1980, 1989; Dauer *et al.* 1982; Baird and Ulanowicz 1989; Diaz and Schaffner 1990). Benthic invertebrates contribute significantly to the diets of juvenile and adult fish and crabs (Chao and Musik 1977; Homer and Boynton 1978; Virnstein 1979; Homer *et al.* 1980; Holland *et al.* 1989). They are also consumed by man (e.g., crabs, oysters, clams) and are an important commercial industry in the Chesapeake Bay. Estuarine benthos also have important roles in ecological processes that affect water quality and productivity. The feeding and burrowing activities of benthos affect sediment depositional patterns and chemical transformations including oxygen, nutrient, and carbon cycles (Carriker, 1967; Rhoads, 1974; Kemp and Boynton 1981). Feeding activities can also remove planktonic components and the concentration of particles in the water column that can improve water clarity (Cloern 1982; Officer *et al.* 1982; Holland *et al.* 1989).

Benthic collections were made with a standard Ponar grab sampler during the seasonal study conducted in 1994-1995 in order to describe the benthic community near Poplar Island (EA 1995a,b,c,d). The sonar was able to sample a 0.5-square-foot area to a depth of approximately 4 inches. Ten stations were sampled in the fall and four stations were added in the winter that were also sampled in the spring and summer (Figure 3-13). The 14 stations were selected in order to obtain information about the benthic community inside and outside the proposed island alignment. The complete data set including abundance and distribution information by station locations is reported in Appendix B. Comparisons of these data will be made with historical data where possible to put the Poplar Island benthic communities in perspective with other areas in the Mesohaline zone (5 to 18 ppt) of the Chesapeake Bay.

A sediment characterization was conducted at each station location in order to describe these components of the benthic habitat (Table 3-15). Substrate is a major environmental factor controlling the spatial distribution of macrobenthic communities (Sanders 1958, Rhoads and Young 1970, Young and Rhoads 1971; Boesch 1973; Mountford *et al.* 1977), while salinity is the major factor influencing regional distributions (Carriker 1967). Based on the grain size analysis, the substrates were homogeneous throughout most of the study area. The predominant substrate at all but one station was fine sand. Station BWQ-8 (Poplar Harbor) consisted of approximately equal parts of sand and silt. Organic matter content was less than 2 percent at all stations. Other *in situ* water quality measurements (temperature, dissolved oxygen, pH) were within expected ranges (Section 3.1.4). Anoxia, which is common in deeper areas of the Chesapeake Bay, was not evident in the shallow (less than 13 feet) Poplar Island study area.

A total of 50 benthic taxa were collected in the vicinity of Poplar Island during the 4 seasons studied (Table 3-16). This total includes organisms identified to species level and also, in the case of very small or damaged specimens, organisms identified only to a major taxonomic group (i.e., class, family). During a long-term benthic study (1971-1974) conducted in the Calvert Cliffs area along the western shore of the Chesapeake Bay, a total of 74 taxa were collected (Mountford *et al.* 1977). This study was conducted in three habitat types: sandy, muddy sand, and muddy habitat in water depths of less than 17 feet. Salinity ranged from 7 to 18 ppt during the study period. Twenty-seven taxa collected near Poplar Island were also collected in the Calvert Cliffs study. It is assumed that the larger species list at Calvert Cliffs is the result of the longer study period and also the greater variety of substrates sampled.

Comparing only the seasonal (1973-1974) Calvert Cliffs data (Mountford *et al.* 1977) from the shallow 10-foot sandy habitat with the Poplar Island data reveals more similarity in community composition. In both studies, two to three taxa dominated the benthic community during each season as follows: fall and summer, the amphipod *Lepidactylus dytiscus* and the polychaete *Heteromastus filiformis*; winter, the polychaete *Marenzellaria viridis* and the clams *Mya arenaria* and *Macoma balthica*; and in the spring, *M. viridis*, *H. filiformis*, and *M. balthica*. Roberts *et al* (1975) summarized the characteristic dominant macrobenthic organisms in the various estuarine zones of the Chesapeake Bay based on a synthesis of 35 information sources. The dominant taxa in the Mesohaline zone sand bottom habitat included *M. arenaria* and *H. filiformis*, both dominants in the Calvert Cliffs and Poplar Island studies. Other dominants cited by Roberts *et al* (1975) were the amphipod *Leptocheirus plumulosus* and the clam *Macoma mitchelli*, which were also dominants in the Poplar Island study.

The number of taxa collected in the sand habitat in the Calvert Cliffs study (Holland 1976) ranged from 11 to 23 collected at 8 stations compared to 31 to 36 in the present study at Poplar Island (14 stations). The number of taxa collected at individual stations near Poplar Island ranged from 8 at stations BWQ-7 (Poplar Harbor) in the fall to 24 taxa at BWQ-5 (near the ranges) in the summer.

Table 3-15 Percent Composition of Sediment Collected near Poplar Island

Station	Percent Clay	Percent Silt	Percent Fine Sand	Percent Medium Sand	Percent Coarse Sand	Percent Organic Matter
BWQ-1	3.08	1.68	93.07	1.35	0.82	0.73
BWQ-2	1.54	2.32	93.37	2.59	0.18	1.24
BWQ-3	4.62	8.23	85.60	1.55	0.00	0.89
BWQ-4	<1	<1	96.66	1.77	0.22	0.56
BWQ-5	3.08	5.39	84.57	6.54	0.42	0.95
BWQ-6	1.54	1.44	96.75	0.25	0.03	0.59
BWQ-7	3.08	5.82	91.00	0.08	0.02	0.55
BWQ-8-104	6.15	46.75	46.97	0.13	0.00	1.34
BWQ-9	1.54	1.93	96.28	0.25	0.00	0.61
BWQ-10	<1	<1	95.15	2.57	1.05	0.86
BWQ-11	3.00	2.45	93.14	0.91	0.50	1.09
BWQ-12	2.00	6.29	91.52	0.13	0.06	1.09
BWQ-13	3.00	4.28	91.91	0.70	0.11	0.99
BWQ-14	3.00	5.76	90.90	0.22	0.12	1.07

TABLE 3-16 Species List of Benthic Invertebrates Collected near Poplar Island

Platyhelminthes	Oligochaeta
Euplana gracilis	Mollusca
Stylochus ellipticus	Gastropoda
Cnidaria	*Sayella chesapeaka*
Anthozoa	Bivalvia
Diadumene leucolena	Bivalvia sp. *(indeterminate)*
Edwardsia elegans	*Mulinia lateralis*
Nemertinea	*Macoma balthica*
Amphiporus bioculatus	*Macoma* spp.
Carinoma tremaphorus	*Macoma mitchelli*
Micrura leidyi	*Gemma gemma*
Annelida	*Mya arenaria*
Polychaeta	Crustacea
Hypereteone heteropoda	*Balanus improvisus*
Hypereteone foliosa	*Neomysis americana*
Nereididae	*Mysidopsis bigelowi*
Neanthes succinea	*Cyclaspis varians*
Laeonereis culveri	*Cyathura polita*
Glycinde solitaria	*Paracereis caudata*
Leitoscoloplos fragilis	*Edotea triloba*
Leitoscoloplos sp.	*Leptocheirus plumulosus*
Polydora cornuta	*Corophium lacustre*
Spiophanes bombyx	*Gammarus sp. (indeterminate)*
Paraprionospio pinnata	*Melita nitida*
Streblospio benedicti	*Lepidactylus dytiscus*
Marenzellaria viridis	*Monoculodes sp. 1*
Capitellidae	*Mucrogammarus mucronatus*
Heteromastus filiformis	*Rhithropanopeus harrisii*
Pectinaria gouldii	Chelicerata
Tharyx sp. A.	*Limulus polyphemus*

Abundance (density) and diversity (Shannon-Weiner index) data were also comparable between the two areas of the Bay. Density in the sand habitat at Calvert Cliffs (Mountford *et al* 1977) ranged from 79 to 11,460/m^2 compared to 463 to 10,786/m^2 at Poplar Island (Table 3-17). Diversity ranged from 1.6 to 2.8 at Calvert Cliffs and generally were lower, ranging from 0.7 to 2.2 at Poplar Island. In the study summarized by Roberts *et al.* (1975), the range of diversity values was generally higher than at Poplar Island.

A study conducted by the EMAP, a nationwide program initiated by EPA, included stations sampled in the numerous locations in the Mesohaline portion of the Chesapeake Bay. Two station locations, one sampled in 1990 in the mainstem Bay south of the Choptank River and a

Table 3-17 Seasonal Summary of Benthic Data Collected Near Poplar Island

STATIONS	BWQ-1	BWQ-2	BWQ-3	BWQ-4	BWQ-5	BWQ-6	BWQ-7	BWQ-8	BWQ-9	BWQ-10	BWQ-11	BWQ-12	BWQ-13	BWQ-14
FALL														
Total Number of Taxa	18	10	17	15	21	13	8	21	13	18	---	---	---	---
Mean Density of Individuals	850.7	1075.1	1087.3	1305.6	2427.6	1177.1	632.4	2454.1	463.1	1387.2	---	---	---	---
Shannon-Weiner Diversity	2.140	1.460	2.050	1.870	1.700	1.540	1.370	2.010	2.030	1.570	---	---	---	---
Species Richness	3.52	1.78	3.15	2.66	3.40	2.33	1.54	3.40	2.84	3.20	---	---	---	---
Eveness	0.74	0.63	0.73	0.69	0.56	0.60	0.66	0.66	0.79	0.54	---	---	---	---
WINTER														
Total Number of Taxa	15	18	13	15	11	14	19	21	15	16	14	13	16	20
Mean Density of Individuals	4488.0	1381.1	897.6	1515.7	381.5	699.7	6487.2	1836.0	1005.7	1958.4	1401.5	2835.6	1917.6	4412.5
Shannon-Weiner Diversity	1.533	1.816	1.788	1.662	2.168	2.098	1.934	2.166	1.932	2.233	2.076	1.949	2.050	1.949
Simpson's Dominance Index	0.359	0.303	0.240	0.282	0.132	0.169	0.201	0.159	0.248	0.132	0.165	0.197	0.172	0.197
Species Richness	2.16	3.20	2.46	2.59	2.48	2.80	2.62	3.57	2.80	2.65	2.44	1.99	2.66	2.93
Eveness	0.57	0.63	0.70	0.61	0.90	0.79	0.66	0.71	0.71	0.81	0.79	0.76	0.74	0.65
SPRING														
Total Number of Taxa	14	23	15	15	23	16	22	19	15	19	19	16	16	21
Mean Density of Individuals	3325.2	3814.8	3372.1	2841.7	3549.6	2380.7	8017.2	3468.0	2727.5	3555.7	3229.3	3310.9	3106.9	5283.6

TABLE 3-17 (continued)

STATIONS	BWQ-1	BWQ-2	BWQ-3	BWQ-4	BWQ-5	BWQ-6	BWQ-7	BWQ-8	BWQ-9	BWQ-10	BWQ-11	BWQ-12	BWQ-13	BWQ-14
SPRING (continued)														
Shannon-Weiner Diversity	1.540	1.904	1.575	1.667	1.826	1.850	2.038	2.000	1.372	1.715	1.693	1.772	1.604	2.074
Simpson's Dominance Index	0.309	0.229	0.297	0.259	0.224	0.195	0.164	0.200	0.421	0.263	0.281	0.247	0.285	0.161
Species Richness	2.10	3.48	2.26	2.32	3.52	2.56	2.97	2.89	2.34	2.88	2.92	2.42	2.45	3.01
Eveness	0.58	0.61	0.58	0.62	0.58	0.67	0.66	0.68	0.51	0.58	0.58	0.64	0.58	0.68
SUMMER														
Total Number of Taxa	18	19	15	17	24	20	21	17	16	16	17	15	17	15
Mean Density of Individuals	2305.2	3223.2	1209.7	2386.8	6195.5	1931.9	10785.5	2637.7	1556.5	2319.5	5942.5	2352.1	1760.5	1128.1
Shannon-Weiner Diversity	2.130	1.431	2.218	1.719	1.528	1.398	0.671	1.852	1.808	1.987	1.090	1.945	2.176	1.956
Simpson's Dominance Index	0.170	0.452	0.142	0.319	0.397	0.486	0.761	0.217	0.242	0.198	0.591	0.191	0.146	0.194
Species Richness	2.92	2.92	2.70	2.73	3.38	3.36	2.71	2.68	2.76	2.57	2.36	2.39	2.88	2.74
Eveness	0.74	0.49	0.82	0.61	0.48	0.47	0.22	0.65	0.65	0.72	0.38	0.72	0.77	0.72

station sampled in 1992 east of Tilghman's Island in Harris Creek, were selected for comparison based on depth and substrate characteristics (Table 3-18). These were compared to two stations sampled at Poplar Island in summer 1995 that had similar characteristics: one inside the proposed alignment (BWQ-4) another station outside the alignment (BWQ-8). The number of taxa collected at Poplar Island was lower than that at the EMAP stations. The sand substrate station (greater than 90 percent sand), EMAP Station 065, had 30 taxa compared to 17 at BWQ-4 (off South Central Poplar). The sandy/mud stations (approximately 50 percent sand/50 percent mud), EMAP station 501, had 36 taxa compared to 17 taxa collected at BWQ-8. Of the 55 taxa collected at the 2 EMAP stations and the 24 taxa from the 2 Poplar Island stations, only 12 taxa were collected in both studies.

The benthic community in the vicinity of the Poplar Island archipelago is comparable to communities in other areas of the Mesohaline zone of the Chesapeake Bay. One taxon, the polychaete *Leitoscoloplos fragilis*, which is uncommon in the Maryland portion of the Bay, was collected in the spring and summer surveys. It was collected at all but one station in the summer, which included stations both inside and outside the alignment. *L. fragilis* is more common in higher salinities, such as those typical of the Virginia portion of the Bay (Mountford, 1995). The dominant taxa found in the present study are typical of benthic communities in shallow sandy substrate habitats in the Mesohaline portion of the Chesapeake Bay. The abundance of benthic invertebrates is also within the normal range reported elsewhere in the Bay. Diversity and number of taxa per station location is somewhat lower than in other studies. The aquatic environment surrounding the island remnants appears to be highly dynamic. The rapid erosion of Poplar Island over the years has caused constant movement of material from intertidal areas and shifting of substrate in the subtidal area. This was evident during existing condition sampling events, when high winds generated plumes of suspended materials emanating from the islands. Environmental variability is greater in shallow water, and, as a result, the shallow subtidal environment is generally much more stressful than deeper benthic environments. (Day *et al* 1989). The stations sampled near Poplar Island were shallower than in the other studies reported, which probably contributed to some of the difference between the Poplar Island benthic community and other areas in the Mesohaline zone of the Bay.

3.1.6.e Submerged Aquatic Vegetation. Until recently, significant submerged aquatic vegetation (SAV) populations occurred in the Chesapeake Bay; however, during the last few decades, many SAV species have undergone a dramatic decline in the Bay and its tributaries. Estimated historical SAV distributions range upward from 100,000 hectares or more Baywide. Aerial surveys place the approximate current coverage of Chesapeake SAV at 24,296 hectares (Orth 1991).

The cause of this SAV decline is speculative. The decline in SAV is generally believed to be the result of increased nutrient loadings and sedimentation (White 1989). Bacterial and viral diseases are also thought to have contributed to the sudden decline in the early 1970's (Bayley *et al.* 1968, Bean *et al.* 1973). SAV is known to be especially sensitive to increased sedimentation and water turbidity, and the erosion of Poplar Island would increase sedimentation and turbidity in the adjacent shallow water SAV habitat. This erosion results in decreasing water

TABLE 3-18 Benthic Invertebrate Collected During the Summer near Poplar Island and at Other Locations In The Chesapeake Bay

Species	BWQ-4	BWQ-8	Station 065 Main Bay[(a)]	Station 501 Harris Creek[(b)]
Platythelminthes				
Stylochus ellipticus	X			
Turbellaria (unidentified)			X	
Cnidaria				
Anthozoa (unidentified)			X	
Annelida **Polychaeta**				
Cirratulidae (unidentified)			X	
Glycera dibranchiata			X	X
Glycinde solitaria		X	X	X
Goniadidae (unidentified)			X	
Heteromastus filiformis	X	X	X	X
Hypereteone foliosa	X			
Hypereteone heteropda			X	X
Hypereteone spp.			X	
Laeonereis culveri		X		
Leitoscoloplos fragilis	X			
Leitoscoloplos spp.				X
Leitoscoloplos robustus				X
Marenzelleria viridis	X	X		X
Neanthes succinea	X		X	X
Nereidae (unidentified)			X	
Parahesione luteola				X
Paranaitis speciosa				X
Paraprionospio pinnata			X	X
Pectinaria gouldii				X
Podarkeopsis levifuscina			X	

TABLE 3-18 (continued)

Species	BWQ-4	BWQ-8	Station 065 Main Bay[a]	Station 501 Harris Creek[b]
Annelida Polychaeta (cont.)				
Polydora websteri				X
Polydora cornuta		X	X	X
Pseudeurythoe paucibranchiata			X	
Spiophanes bombyx			X	
Streblospio benedicti	X	X	X	X
Tharyx sp. A			X	
Oligochaeta		X	X	X
Arthropoda Crustacea				
Balanus improvisus				X
Balanus spp.				X
Cyclaspis varians	X	X		
Cyathura polita	X	X		X
Edotea triloba	X	X		
Hargeria rapax				X
Lepidactylus dytiscuc	X			
Leptocheirus plumulosus	X	X		
Monoculodes sp. 1	X	X		
Neomysis americana	X	X		
Mollusca Gastropoda				
Acteocina canaliculata			X	
Acteon punctostriatus			X	X
Cratena pilata				X
Haminoea solitaria				X

TABLE 3-18 (continued)

Species	BWQ-4	BWQ-8	Station 065 Main Bay[a]	Station 501 Harris Creek[b]
Mollusca **Gastropoda (cont.)**				
Odostomia engonia				X
Odostomia spp.			X	
Pyramidellidae (unidentified)				X
Sayella chesapeakea				X
Unidentified gastropod				X
Bivalvia				
Crassostrea virginica				X
Ensis directus			X	
Gemma gemma	X	X	X	
Geukensia demissa				X
Ischadium recurvum				X
Macoma balthica				X
Macoma mitchelli		X		X
Mulinia lateralis	X		X	X
Mytilidae (unidentified)				X
Parvilucina multilineata			X	
Chordata				
Molgula manhattensis				X
Ascidiacea (unidentified)			X	
Hemichordata				
Saccoglossus kowalevskii			X	
Phoronida				
Phoronis spp.			X	

TABLE 3-18 (continued)

Species	BWO-4	BWO-8	Station 065 Main Bay[(a)]	Station 501 Harris Creek[(b)]
Nemertinea				
Carinoma tremaphorus		X		
Micrura leidyi	X	X		
Unidentified			X	X

(a) Station 065 -- approximately 26 feet deep; in mainstem Bay, south of Choptank River; bottom salinity 15.4 ppt; bottom DO 4.1 mg/l; 99% sand, 1% siltclay

(b) Station 501 -- approximately 11 feet deep; east of Tilghman Island in Harris Creek; bottom salinity 14.1 ppt; bottom DO 6.8 mg/l; 49% sand, 51% siltclay

quality and clarity. SAV normally occurs in water depths to 10 feet, the depth to which light penetration generally permits the growth of rooted aquatic plants; however, because of increasedturbidity, most SAV is currently found in water depths of 3 to 5 feet or less in the Bay (Batiuk *et al.* 1992).

The Poplar Island vicinity has historically supported extensive SAV beds (G&B and M&N 1995a). A 1978 DNR Baywide SAV survey documented aquatic plant beds adjacent to all of the six islands in the Poplar Island group (Wolflin 1995). A 1984 survey indicated small SAV beds adjacent to Coaches Island, but not adjacent to the other islands, and those beds have not been documented since 1984. Anecdotal references state that in the past, Poplar Island Harbor, located to the east of the smaller Poplar Island remnants, supported large colonies of grass beds (Blankenship 1994). It is believed that these former SAV beds were primarily composed of sago pondweed (*Potamogeton pectinatus*), redhead grass (*Potamogeton perfoliatus*), widgeon grass (*Ruppia maritima*), and horned pondweed (*Zanichellia palustris*) (Wolflin 1995).

True-color aerial photographs were taken to document potential SAV bed distribution in May and August 1995. The May aerial photographs were taken to detect any potential early-growth SAV beds, primarily those consisting of horned pondweed. Neither May nor August photographs revealed any identifiable SAV beds.

During summer 1995 field investigations, SAV presence within the general Poplar Island area was documented. SAV was observed growing in the sediment of the shallow water of Poplar Harbor, floating in the water, and washing up on the shore of Coaches Island. SAV species found floating throughout the general area include widgeon grass, redhead grass, horned pondweed, and water-milfoil (*Myriophyllum spicatum*). Species found washed up on the shore of Coaches Island include widgeon grass, horned pondweed, and water-milfoil. SAV species found growing in the sediment of Poplar Harbor include widgeon grass, horned pondweed, and sago pondweed (Figure 3-15). During both the June and July 1995 investigations, the SAV beds were observed only in a few small areas and in low density.

3.1.7 Terrestrial Resources

3.1.7.a General Characterization. Investigations of the four remnant islands of the Poplar Island archipelago were conducted during fall, winter, spring, and summer surveys in 1994 and 1995 (EA 1995a, b, c, d). Coaches Island was added to the winter, spring, and summer surveys.

The four remnant islands possess low and high marsh areas; North Point and South Central Poplar Island have saltbush communities. None of the four smaller remnant islands has live woodland tree cover (Figure 3-16). Middle Poplar Island has standing dead trees remaining, with evidence of a previously greater woodland extent (e.g., logs, limbs, and snags in immediate offshore waters) (EA 1995a). The majority of the plants occurring on the four remnant islands are herbaceous plants that are common to brackish marsh, and saltmarsh habitats with few woody shrub and vine species present.

Coaches Island encompasses approximately 74 acres and is the largest remaining tract of land in the Poplar Island archipelago, accounting for approximately 75 percent of the total remaining land mass currently present on the six islands (EA 1995b). Coaches Island contains upland forest areas with wetland inclusions, low and high tidal marshes, man-made impoundments, and maintained lawn areas (Figure 3-17). These lawn areas are primarily associated with the dwelling on the island and with areas around the man-made ponds. A portion of the northern shore of the island, adjacent to Poplar Harbor, is protected by rip-rap.

3.1.7.b Vegetative Community Characterization.

North Point Island

Plant communities present on this island include low marsh, high marsh, and higher high marsh (i.e., saltbush community). The low marsh areas are dominated by smooth cordgrass (*Spartina alterniflora*) in an irregular band that intersperses with high marsh plant species. High marsh areas on this island are dominated by salt meadow cordgrass (*S. patens*) and are generally at slightly higher elevations than the *S. alterniflora*. These higher marsh remnants dominate a broader marsh area at the southern end of the island. *S. patens*-dominated areas also contain lower frequency occurrence of intermingled salt grass (*Distichlis spicata*). Discrete areas on elevated bank remnants contain big cordgrass (*S. cynosuroides*). The northern end of the island and the higher points along its center contain a saltbush community dominated by marsh elder (*Iva frutescens*). Other subdominant plant species present in these areas include saltmarsh fleabane (*Pluchea purpurascens*), saltmarsh aster (*Aster subulatus*), marsh orache (*Atriplex patula*), slender glasswort (*Salicornia europea*), and cordgrasses.

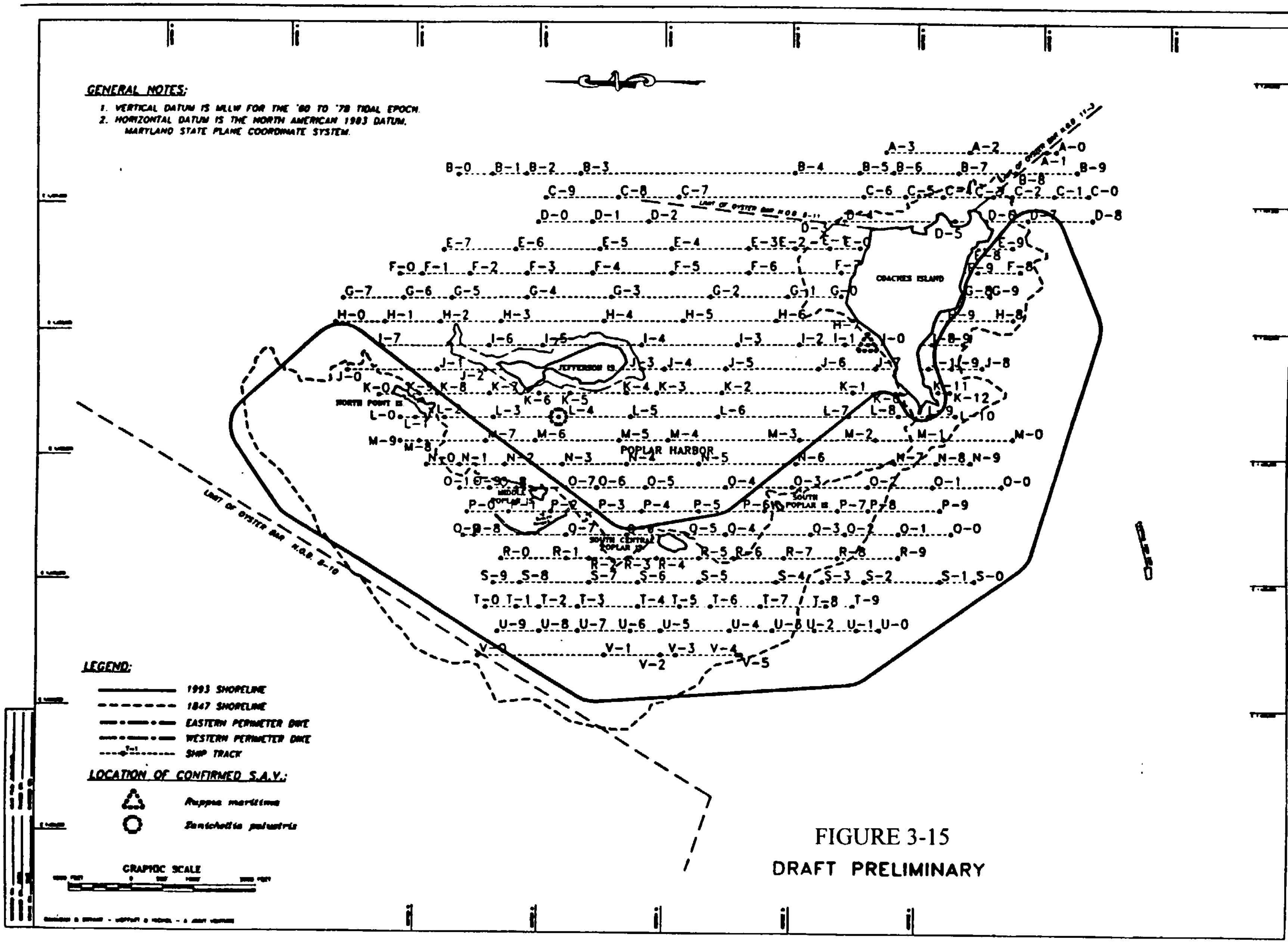
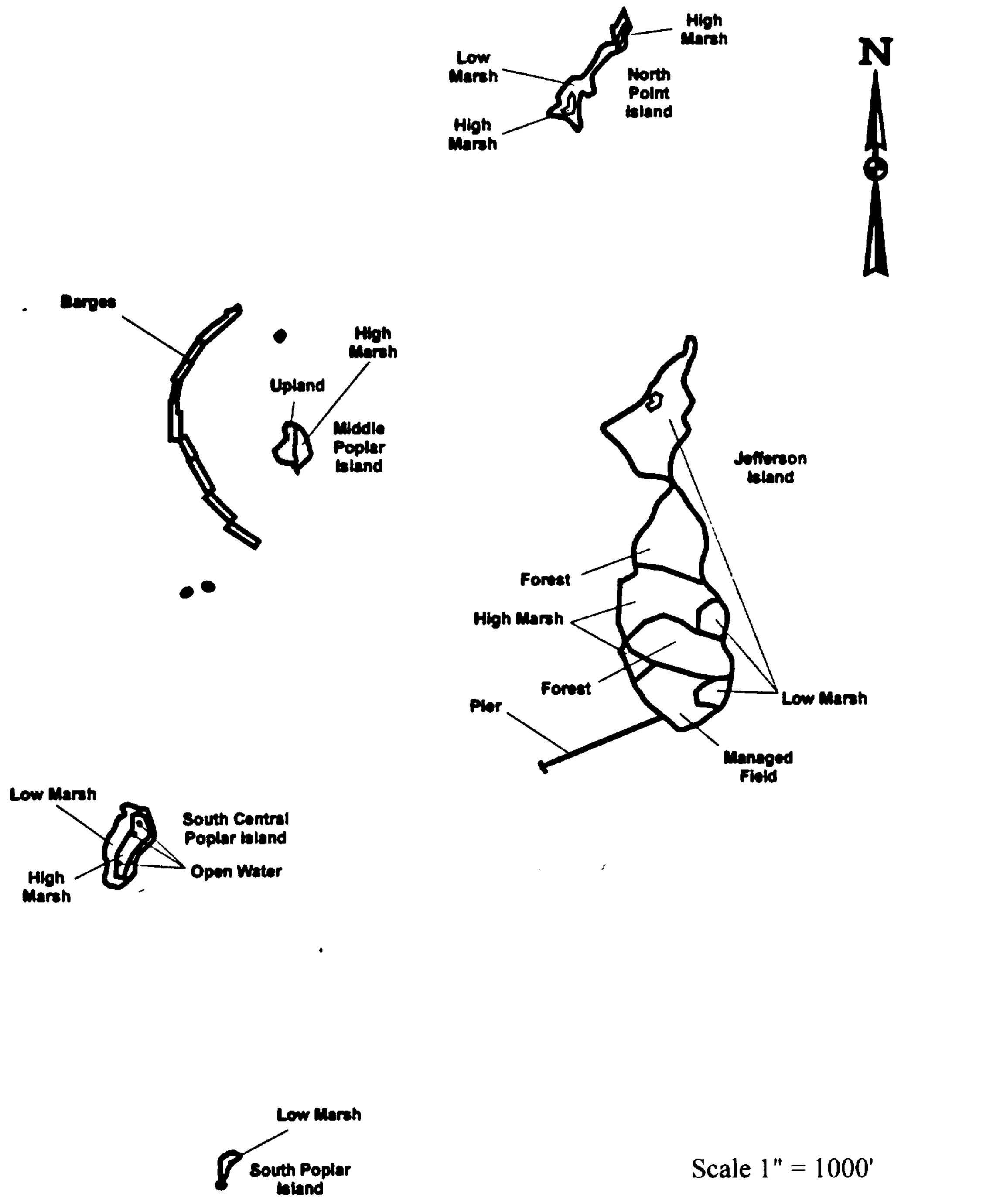
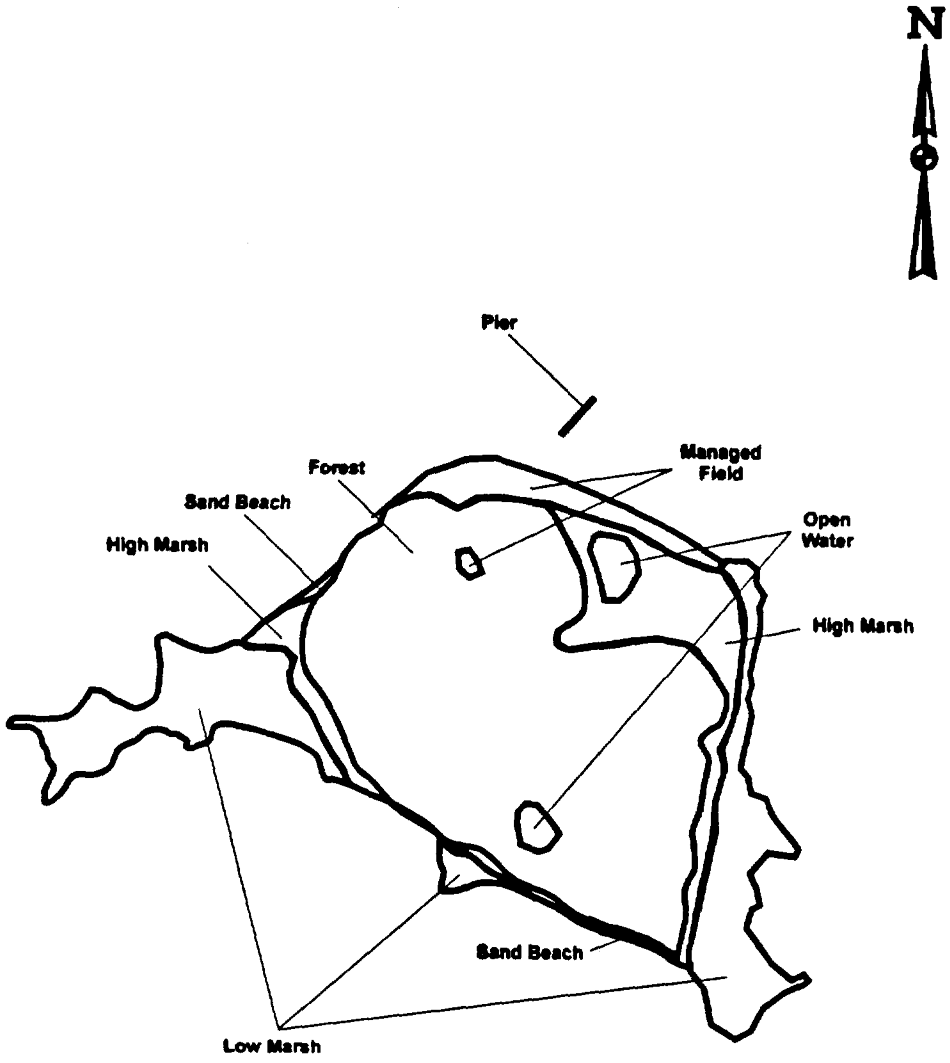


FIGURE 3-15
DRAFT PRELIMINARY



Vegetative communities of the four Poplar Island remnants.

FIGURE 3-16



Scale 1" = 1000'

Vegetative communities of Coaches Island.

FIGURE 3-17

Middle Poplar Island

The dominant vegetation on this island is a stand of common reed (*Phragmites australis*). This stand is interspersed with barnyard grass (*Echinochloa crusgalli*). There are small peripheral stands of smooth cordgrass and saltmeadow cordgrass on the northern and eastern fringes of the island, with minimal occurrence of saltgrass noted. The highest area of the island, central to south and southwest sides, contains remnants of large standing dead trees. Small clumps of field garlic (*Allium vineale*) have been observed near the dead trees, while the remainder of the area under the trees is unvegetated. Vegetation adjacent to the common reed-dominated area include pokeweed (*Phytolacca americana*) and beach grass (*Panicum amarulum*). No significant saltbush community exists on this island. Only a few marsh elder and stunted American elder (*Sambucus canadensis*) shrubs have been noted.

South Central Poplar Island

The shoreline areas of this island contain some stretches of smooth cordgrass in a band, particularly in the low marsh areas on the western side. On the leeward (east) side of the island there is an unvegetated area of sand, shell, and other fragmented materials forming a beach. Above the areas containing smooth cordgrass, common reed exists in larger stands. Interspersed throughout the common reed are areas of smooth cordgrass and saltmeadow cordgrass, with other herbaceous plants present, including field sandbur (*Cenchrus longispinus*). The windward side of the island and portions of the interior and southern end contain a saltbush community dominated by marsh elder, with both seaside goldenrod (*Solidago sempevirens*) and saltmarsh fleabane also present. The high marsh herbaceous plants include saltmeadow cordgrass, marsh fimbry (*Fimbristylis castanea*), and others. An area containing saltmarsh bulrush (*Scirpus robustus*) was identified within the northside interior high marsh center of the island. The remainder of the island contains similar high marsh vegetation with interspersed tidal ponds. One of these features is a small unvegetated salt panne near the center of the island. Another irregularly shaped pond has a restricted tidal channel connection to adjacent open water.

South Poplar Island

This is an approximately 50-foot-wide by 100-foot-long, rapidly eroding island with eroded peat banks. The island appears to be frequently overwashed at high tide, and a segment of the southern end has been separated by a tidal cut. The remnant tidal marsh of this island is dominated by smooth cordgrass, with saltmeadow cordgrass as a subdominant. A few saltgrass and other plants occur, including common reed and seaside goldenrod. No live shrubs are present on this island, although a few dead remains of marsh elder were observed in the fall of 1995 and are evidence of previous, more extensive plant occurrence (EA 1995a).

Coaches Island

Tidal saltmarsh areas on Coaches Island account for approximately 22 acres, or 30 percent of the island's land area (EA 1995b). The high marsh areas are dominated by saltmeadow cordgrass, with saltgrass also present. Other herbaceous plants are also present, with relatively homogeneous stands of black needlerush (*Juncus roemerianus*) occurring in discrete areas. Other plants present and dominant in small localized patches include Olney three-square (*Scirpus americanus*), saltmarsh bulrush (*Scirpus robustus*), and narrow-leaf cattail (*Typha angustifolia*). High elevation areas around the periphery of the saltmarsh meadow support saltbush plants. This community is dominated by marsh elder with southern bayberry (*Myrica cerifera*), Eastern red cedar (*Juniperus virginiana*) and few groundsel individuals (*Baccharis halimifolia*). Frequently the edges of the high marsh areas contain stands of common reed on this island and some tide pool habitat was identified within the high marsh. The primary plant species present in the narrow low marsh bands, which appear to be continuously eroding, is smooth cordgrass with colonization of the upper shore-zone by common reed.

The upland areas of Coaches Island are dominated by a mixed woodland of deciduous and evergreen trees that occupies approximately 42 acres or 57 percent of the island's land cover. Sweet gum (*Liquidambar styraciflua*) and several oak species (*Quercus rubra*, *Q. falcata*, *Q. alba* and *Q. phellos*) dominate the interior of the wooded area that is interspersed with loblolly pine (*Pinus taeda*). The greatest concentrations of pine trees occur along the woodland edge adjacent to the high marsh. Other canopy trees occurring throughout include red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), blackgum (*Nyssa sylvatica*), and black cherry (*Prinus serotina*). Midstory trees include American holly (*Ilex opaca*) and flowering dogwood (*Cornus florida*), with Eastern red cedar (*Juniperus virginiana*) towards the periphery. Toward the western side of the island, the canopy of the woodland is more open; the average canopy closure in this area (EA 1995d) was 50.6 percent. This area also shows signs of human management such as cutting of trees and pruning of limbs to maintain open pathways. Another factor in the relatively open nature of this part of the woodland is considerable fallen limb, possibly associated with wind, storm, or ice damage.

Other woody plants that would generally constitute an understory are sparse. This may be due in some cases to the maturity of the stand or to the deer population currently on the island. Shrubs that have been identified in the woodlands on Coaches Island include highbush blueberry (*Vaccinium corymbosum*) and black haw (*Viburnum prunifolium*). Woody vines identified on Coaches Island include greenbrier (*Smilax rotundifolia*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), Japanese honeysuckle (*Lonicera japonica*), and trumpet creeper (*Campsis radicans*). Dense vine cover, primarily common greenbrier, occurs in transitional areas on the edge of the woodlands, where they grade to tidal marsh communities.

Herbaceous plants occurring within the woodlands on Coaches Island include field garlic (*Allium vineale*) and pokeweed (*Phytolacca americana*); in the more open areas, panic grass (*Dichanthelium sabulorum*) dominates. Wetter areas within the woodlands include Pennsylvania smartweed (*Polygonum pensylvanicum*) and marsh fern (*Thelypters palustris var. pubescens*), among others.

Maintained Field Areas

The managed fields occupy approximately 6 acres, or 8 percent of the island, and generally include mowed grasses such as fescues (*Festuca* spp.), broomsedge (*Andropogon virginicus*), and panic grass (*Dichanthelium* sp.). Other herbaceous plants present in these maintained areas include violets (*Viola* spp.), dandelion (*Taraxacum officinale*), and thistle (*Cirsium* sp.), among others.

Interior Ponds

Three impoundments, which appear to be manmade, exist on Coaches Island. The areas around these ponds are maintained by mowing. Plant species identified in and around the edges of these ponds include soft rush (*Juncus effusus*), wool-grass (*Scirpus cyperinus*), taper-tip rush (*Juncus acuminatus*), Pennsylvania smartweed, forked rush (*Juncus dichotomus*), lesser duckweed (*Lemna minor*), water hyacinth (*Eichornia crassipes*), and yellow-fruited sedge (*Carex annectens*).

A comprehensive list of the plant species identified on Coaches Island is provided as Table 3-19.

3.1.7.c Avifauna. A variety of bird species have been identified in the Poplar Island study area during the four quarterly seasonal surveys conducted by EA. These surveys include timed bird observation stations established at two points on each island (EA 1995a,b,c,d). The birds identified included transitory migrants (primarily spring and fall), overwintering birds, and breeding season residents. Many different groups or guilds of birds were observed, including colonial waterbirds (gulls and terns, long-legged, wading, and other water-birds) shore birds and marsh birds, waterfowl, predatory and scavenging birds, and miscellaneous land birds (primarily on Coaches Island). Colonial nesting birds within the study area include the family Ardeidae (herons and bitterns), the family Phalacrecoracidae (cormorants) and the family Laridae (gulls and terns).

Herons observed in the Poplar Island study area include great blue heron (*Ardea herodius*), great egret (*Casmeiodius albus*), snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), and cattle egret (*Bubuleus ibis*). Breeding colonies of egrets and herons occur on Coaches Island and Middle Poplar Island. A great blue heron colony occurs on the eastern half of Coaches Island, estimated to be more than 100 nesting pairs, with fewer great egret observed (only about 3 to 5 nesting pairs). During the summer (July 1995), a mixed nesting colony of cattle egret and snowy egret were in the midstory of the woodlands on the northeastern end of the island. Observations from the periphery of this colony revealed an estimated 100 birds, including juveniles that appeared nearly fully feathered (EA 1995d). Small nesting colonies of little blue heron and snowy egret occur on Middle Poplar Island as observed in 1995 (EA 1995c). These birds nested within the common reed-dominated vegetation on the island on the opposite side from the cormorant colony. All but a few individuals were absent from the island during the summer bird observations conducted (EA 1995d).

The double-crested cormorant (*Phalacrocorax auritus*) has a nesting colony on Middle Poplar Island. The cormorant colony occupies the dead snags and barren ground underneath, on which the birds have built their densely clustered nests made of sticks and other vegetation fragments. This colony is estimated to contain as many as 500 nesting pair of cormorants (EA 1995c). The cormorants have also been observed throughout the study area flying to and from foraging areas

Table 3-19 Vegetation Identified on Coaches Island and Surrounding Vicinity, Talbot County, Maryland, 1995

Scientific Name	Common Name	Hydrophytic Status [a]
Trees		
Acer rubrum	Red maple	FAC
Carya tomentosa	Mockernut hickory	UPL
Cornus florida	Flowering dogwood	FACU-
Fagus grandifolia	American beech	FACU
Ilex opaca	American holly	FACU+
Juniperus virginiana	Red cedar	FACU
Liquidambar styraciflua	Sweet gum	FAC
Liriodendron tulipifera	Tulip poplar	FACU
Nyssa sylvatica	Black gum	FAC
Pinus taeda	Loblolly pine	FAC-
Prunus serotina	Black cherry	FACU
Quercus rubra	Northern red oak	FACU-
Quercus falcata	Southern red oak	FACU-
Quercus alba	White oak	FACU-
Quercus phellos	Willow oak	FAC+
Shrubs		
Baccharis halimifolia	Groundsel tree	FACW
Iva frutescens	Marsh elder	FACW+
Myrica cerifera	Southern bayberry	FAC
Vaccinium corymbosum	Highbush blueberry	FACW
Viburnum prunifolium	Black-haw	FACU
Herbs		
Allium vineale	Field garlic	FACU-
Arenaria sepyllifolia	Thyme-leaf sandwort	FAC
Asclepias syriaca	Common butterfly weed	UNK
Aster sp.	Aster	UNK
Chlorophyta sp.	Filamentous green algae	OBL

TABLE 3-19 (continued)

Scientific Name	Common Name	Hydrophytic Status[a]
Herbs (Continued)		
Cirsium sp.	Thistle	UNK
Eichhornia crassipes	Water hyacinth	OBL
Enteromorpha sp.	Green seaweed	OBL
Lemna minor	Lesser duckweed	OBL
Phytolacca americana	Pokeweed	FACU+
Pluchea purpurascens	Saltmarsh camphor weed	OBL
Polygonum pensylvanicum	Pennsylvania smartweed	FACW
Polygonum perslcaria	Lady's thumb	FACW
Ranunculus arbortivus	Kidney-leaved buttercup	FACW-
Solidago sempervirens	Seaside goldenrod	FACW
Stellaria media	Common chickweed	UPL*
Taraxacum officinale	Dandelion	FACU-
Thelypteris palustris var. pubescens	Marsh fern	FACW+
Ulva lactuca	Sea lettuce	OBL
Verbascum sp.	Mullein	UNK
Grasses, Sedges, and Rushes		
Andropogon virginicus	Broom sedge	FACU
Carex annectens	Yellow-fruit sedge	FACW
Cyperus odoratus	Rusty flatsedge	FACW
Dicanthelium acuminatun	Hairy panic grass	FAC
Dicanthelium sphaerocarpon	Round seed panic grass	FACU
Distichlis spicata	Saltgrass	FACW+
Elymus virginicus	Virginia wild-rye	FACW-
Fimbristylis casteanea	Marsh fimbry	OBL
Juncus acuminatus	Taper-tip rush	OBL
Juncus dichotomus	Forked rush	FACW
Juncus effusus	Soft rush	FACW+

TABLE 3-19 (continued)

Scientific Name	Common Name	Hydrophytic Status[a]
Grasses, Sedges, and Rushes (Continued)		
Juncus gerardi	Salt meadow rush	FACW+
Juncus roemerianus	Black needlerush	OBL
Panicum acuminatum	Acuminate panic grass	FAC
Panicum virgatum	Switchgrass	FAC
Phragmites australis	Common reed	FACW
Scirpus americana	Olney's bulrush	OBL
Scirpus cyperinus	Wool-grass	FACW+
Scirpus robustus	Saltmarsh bulrush	OBL
Setaria sp.		UNK
Schizachyrium scoparium	Little bluestem grass	FACU-
Spartina alterniflora	Smooth cordgrass	OBL
Spartina cynosuroides	Big cordgrass	OBL
Spartina patens	Saltmeadow cordgrass	FACW+
Vines		
Campsis radicans	Trumpet creeper vine	FAC
Lonicera japonica	Japanese honeysuckle	FAC-
Parthenocissus quinquefolia	Virginia creeper	FACU
Smilax rotundifolia	Greenbrier	FAC
Toxicodendron radicans	Poison ivy	FAC
Submerged Aquatic Vegetation		
Myriophyllum spicatum	Eurasian water-milfoil	OBL
Ruppia maritima	Widgeongrass	OBL
Zannichellia palustris	Horned pondweed	OBL

(a) Indicator Status Categories are from Reed, P.B. Jr. (1988). The U.S. Fish and Wildlife National List of Plant Species That Occur in Wetlands: Northeast (Region 1), unless indicated otherwise.

Abbreviations:
- OBL = Obligate (found in wetlands in more than 99% of all findings)
- FACW = Faculative wetland (66-99%)
- FAC = Faculative (33-66%)
- FACU = Faculative upland (1-33%)
- UP = Upland (< 1%)

* Status not listed by the Fish and Wildlife Service, assumed to be UPL (Upland).

and resting on open water. This colony is one of only two nesting colonies for this species in Maryland, and the Poplar Island colony is the larger of the two.

Members of the gull and tern family observed in the study area include common tern (*Sterna hirundo*), least tern (*Sterna antillarum*) and gull-billed tern (*Gelochelidiron nilotica*). The terns observed in the area have been primarily observed in spring, summer, and fall surveys (EA 1995a,c,d), flying and foraging for small fishes. The area between Coaches Island and South Poplar Island has appeared to be an area of significant tern foraging activity. No terns have been observed in breeding colonies in the study area, although an effort has been undertaken by DNR to encourage least tern nesting on one of the barges in front of Middle Poplar Island, including the placement of shell material and least tern decoys, and the playing of least tern vocalization tapes. To date, there are no indications that this effort has been successful. Gulls that have been observed throughout the study area include herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*), laughing gull (*Larus atricilla*), and ring-billed gull (*Larus delawarensis*). Gulls have been observed in the Poplar Island study area during all seasons. The predominant gull species observed in the area is the herring gull. The barges adjacent to Middle Poplar Island are heavily utilized by gulls as a resting area.

3.1.7.d <u>Waterfowl.</u> Waterfowl observed in the study area include dabbling ducks, diving ducks, sea ducks, geese, swans, loons, and coot. Dabbling ducks observed in the Poplar Island vicinity include mallard (*Anas platyrhynchos*) and American black duck (*Anas rubripes*). Mallards were observed primarily in the areas of the impoundments on Coaches Island, with lesser numbers observed in the estuarine waters of the study area. Black duck were observed in low numbers throughout the study area, including the remnant island habitats and the tidal marsh areas of Coaches Island. Black ducks and probable black ducks, mallard hybrids, were observed nesting in the study area (EA 1995c,d). In June 1995, a black duck hen was flushed from her nest in a high marsh area on the south side of Coaches Island. A black duck hen was also flushed from a nest in a high marsh area on South Central Poplar Island in July 1995, and a black-mallard duck hybrid nest was discovered on North Point Island under a marsh elder shrub. An additional black duck-mallard hybrid hen was flushed from a nest in marsh grasses near the boat slip on Coaches Island. Two additional black ducks were flushed from marsh grass cover, one on Middle Poplar Island and one on South Central Poplar Island, but the potential nest location was not found in either case. The black duck and black duck-mallard hybrid hens that were flushed from active nests were incubating clutches of 10, 7, 8, and 11 eggs ($\bar{x}=9$, $n=4$).

Ducks grouped as "divers" observed in the Poplar Island study area were identified primarily during fall and winter site surveys conducted by EA (1995a, b). These seasonal migrants and winter residents were primarily identified resting and foraging in open water areas and flying throughout the study area. Diving ducks observed include bufflehead (*Bucephala albeola*), greater scaup (*Aythya marila*), canvasback (*Aythya valisineria*), and hooded merganser (*Lophodytes cucullatus*).

Sea ducks, which also have a diving propensity, are often grouped separately from other diving ducks due to their predominantly open Bay and inshore coastal water habitation. Sea ducks identified as present in the Poplar Island vicinity include primarily oldsquaw (*Clangula hyemalis*), with white-winged scoter (*Melanitta fusca*) and common eider (*Somateria mollissima*). These birds were observed flying, foraging, and resting in the relatively deeper open water areas, primarily in winter. Though not observed, Surf Scoter (*Melanitta perspicillata*) and Black Scoter (*Melanitta nigra*) are commonly found around Poplar Island.

Larger waterfowl, specifically mute swan (*Cygnus olor*) and Canada goose (*Branta canadensis*) have been observed in small numbers in the Poplar Island study area. These observations are primarily associated with the island habitats and adjacent near-shore shallow waters. Both Canada geese and mute swan were observed in breeding and nesting attempts on Coaches Island. In fall 1994, a pair of mute swan were observed with one cygnet in the vicinity of Middle Poplar Island (EA 1995a). A nesting pair of mute swan were observed in the east-side marsh on Coaches Island in spring 1995. During the summer survey (EA 1995d), the nest was found to be abandoned, containing two eggs, one whole and one destroyed, with a well-developed swan in it. There have been Canada geese observed in pairs and exhibiting territory defense behavior, particularly near the ponds on Coaches Island, but no goslings were observed during EA surveys.

Other duck-like birds observed in the Poplar Island study area include common loon (*Gavia immer*) and American coot (*Fulica americana*), which were observed in shallow open water areas near the island remnants in fall 1994 (EA 1995a).

Predatory and Scavenging Birds

This group includes the family Pardionidae (ospreys), the family Accipitridae (hawks and eagles), the family Corvidae (jays, magpies and crows), and the family Cathartidae (new world vultures). The bird species in these groups identified in the Poplar Island study area include osprey (*Pantion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), American crow (*Corvus brachyrhynchos*), fish crow (*Corvus ossifragus*), and black vulture (*Coragyps atratus*).

Bald eagles present in the study area vicinity are associated with a nest on Jefferson Island and have been observed flying in the area, sitting on the nest, and perching on snags. The ospreys observed have been associated with nesting attempts on all of the islands in the study area. South Poplar is the only island where a successful nesting attempt was not completed. Ospreys have been observed flying and foraging throughout the open waters of the study area and engaged in nesting activities, including incubating and caring for young. The ospreys and eagles were observed in the study area during spring and summer surveys (EA 1995c,d).

Common crows were observed in low numbers throughout the study area and during all seasons. A few individual fish crow and black vulture were observed.

Shore Birds and Marsh Birds

These groupings of birds represent a variety of bird families, but are lumped here for their habits and areas of occurrence.

Shore birds identified in the Poplar Island study area include willet (*Catopitrophorus semipalmatus*), dunlin (*Calidris alpina*), semi-palmated sandpiper (*Calidris pusila*), and killdeer (*Charadrius vociferus*). Nesting pairs of willet were identified in the study area on Coaches Island and North Point Island. Males in nesting territory defense were observed on Coaches Island and North Point Island in spring and summer 1995. Additionally, a dead juvenile willet was discovered in a tidal marsh area on Coaches Island during the summer survey conducted in July 1995 (EA 1995d).

Marsh birds characterized as those identified in the low and high marsh areas include marsh wren (*Cistothorus palustris*), sharp-tailed sparrow (*Ammodramus caudacutus*), red-winged blackbird (*Agelaius phoeniceus*), and common yellow throat (*Geothlepis trichas*). All of these species are potential breeding birds of the tidal marshes on Coaches Island and the remnant island habitats. Male red-winged blackbirds were observed in territorial displays in marshes throughout the study area.

Miscellaneous Land Birds

This category of birds includes several bird species typically associated with mainland terrestrial habitats, including forests, scrub-shrub, and field habitats. A variety of common migratory songbirds typically associated with adaptation to fragmented human-influenced landscape were observed. These included Northern cardinal (*Cardinalis cardinalis*), mockingbird (*Mimus polyglottos*), brown-headed cowbird (*Molothrus ater*), common grackle (*Quiscalus quiscula*), gray catbird (*Dumetella carolinensis*), and chipping sparrow (*Spizella passerina*).

3.1.7.e Mammals. The only portion of the study area where mammalian presence has been identified is on Coaches Island. The most evident mammal on the island is the white-tailed deer (*Odocoileus virginianus*). Deer were observed throughout the island, including individuals and herds of 5 to 11 members (EA 1995c). Raccoon (*Procyon lotor*) was identified as present on Coaches Island by sign including tracks and scat. By all appearances, raccoon are present on this island in very low numbers, but no direct observations of raccoon were made by EA scientists. Other mammalian carnivores (e.g., red fox) were observed. Another mammalian species noted on Coaches Island is muskrat (*Ondatra zibethicus*), evidenced by lodges, trails, and scat.

3.1.7.f Reptiles and Amphibians. Reptiles and amphibians were identified on Coaches Island only. Observations were made throughout the seasonal investigations and by specific pit fall trapping efforts conducted during the spring and summer surveys (EA 1995c,d). Snakes are the most abundant herptiles observed. These observations include Eastern kingsnake (*Lampropeltis getulus getulus*), which were almost exclusively observed in high marsh areas, particularly under plywood boards. Another commonly occurring snake species observed was the Northern water snake (*Nerodia sipedon*); these were observed particularly along rip-rap areas of the shoreline, sometimes in groups of three or more snakes. Another snake found on Coaches Island was the Eastern garter snake (*Thamnophis sirtalis*). One individual was observed in the woodlands on the eastern side of Coaches Island.

Amphibians found included one frog and one toad species on Coaches Island. These species were Southern leopard frog (*Rana utricularia*) and Fowler's toad (*Bufo woodhousei fowleri*). The frogs were identified near the impoundments on the island, and two were captured at a drift fence location during the summer survey efforts (EA 1995d). A Fowler's toad was also captured and identified in this fashion. Another unidentified frog, *Rana* sp., is believed to be present in the ponds on Coaches Island.

The Eastern mud turtle (*Kinosternon subrubrum*) and Eastern box turtle (*Terrapene carolina*) were identified on the island. These were associated with the impoundments and woodland areas, respectively. Another reptile identified on the island was a single six-lined racerunner (*Cnemidophorus sexilineatus*) found on a dead snag in an open woodland area during the summer environmental survey (EA 1995d).

3.1.8 Rare, Threatened, and Endangered Species (RT&E)

3.1.8.a Introduction. Certain species of plants and animals are protected by Federal and State regulations under the Endangered Species Act (ESA) of 1973 and the Maryland Nongame and Endangered Species Conservation Act of 1975. Under the consistency clause (Section 7[a]) of the ESA, Federal agencies are required to consult with the USFWS and NMFS (where appropriate) if a prospective permit or license applicant has reason to believe that endangered or threatened species may be present in the area affected by a proposed project. The Maryland Nongame and Endangered Species Conservation Act has a similar consultation requirement regarding potentially affected protected species.

In accordance with the Federal and State requirements, consultation was conducted with the USFWS Ecological Services office in Annapolis, Maryland; the Habitat and Protected Resources Division of the NMFS in Oxford, Maryland; and DNR's Fish, Heritage and Wildlife Administration located in Annapolis, Maryland. Information requested from these agencies included Federal- and State-listed threatened and endangered species, designated or proposed critical habitat, and candidate taxa occurring in the project area.

Previous correspondence from the USFWS (Appendix C), however, provided some information regarding RT&E occurrence. This information includes reference to the federally listed endangered bald eagles nesting on Jefferson Island and indicated that, in 1994, no young were fledged from this nest. The USFWS has proposed reclassification of the bald eagle to threatened status. The USFWS letter (Wolflin 1995) also mentioned the least tern as federally endangered for the West Coast and Central Plains populations; the Atlantic Coast breeding population is not federally listed. The summary statement provided by the USFWS indicates that, except for occasional transient individuals, the Poplar Island complex is not known to support any other federally listed, proposed, or candidate species.

The response letter from NMFS (Goodger 1995; Appendix C) provided a list of endangered and threatened aquatic species within this agency's purview. The list included a variety of marine mammals, sea turtles, and Shortnose sturgeon (*Acipenser brevirostrum*). The NMFS response letter (Goodger 1995) pointed out that, except for occasional transient individuals, these species are not likely to occur in the project area. Consequently, no further coordination pursuant to Section 7 of the ESA is required, unless new information becomes available or project conditions change.

The RT&E response sent by DNR (Miller 1995; Appendix B) referenced the bald eagle nest on Jefferson Island and also mentioned the long history of colonial nesting water bird use.

3.1.8.b Federally Protected Species Identified. Bald eagles (*Haliaeetus leucocephalus*) were observed on Jefferson Island in the spring and summer of 1995, including a nesting pair. No fledged offspring from the 1995 nesting season were observed during 1995 field investigations (EA 1995c, 1995d).

No other federally listed animal species or plant species was identified in the Poplar Island study area vicinity.

3.1.8.c State Protected Species Identified. By virtue of being federally listed as "endangered," the bald eagle species is also required to be state-listed as "endangered," and the various comments on bald eagle occurrence apply.

The least tern species is listed as "threatened" in the State of Maryland. It was observed in the fall and summer flying over and foraging in the open water areas of the Poplar Island study area (EA 1995a,b,c,d). No nesting colonies have been identified as occurring within the study area even though resource agency efforts have been directed toward encouraging least tern nesting on one of the grounded barges adjacent to Middle Poplar Island.

The gull-billed tern is also listed as "threatened" by the State of Maryland. It was identified as flying and foraging in the Poplar Island study area, particularly in the area between South Poplar and Coaches Islands in summer 1995 (EA 1995d).

Additional species of concern that lack protected status by the State of Maryland have been identified in the Poplar Island study area. These species are designated as "watchlist" and highly state rare. Two bird species identified in the project vicinity that are state watchlist species are the little blue heron (*Egretta caerulea*) and the sharp-tailed sparrow (*Ammodramus caudacutus*). Two bird species identified in the project vicinity that are listed as" highly state rare" are the laughing gull (*Larus atricilla*) and the hooded merganser (*Lophodytes cucullatus*). These four bird species are designated as "migrants". The state rank refers to the breeding status of the species; there may be a different rank for non-breeding populations.

No state-protected plant species have been identified in the flora of the Poplar Island study area.

3.1.9 Air Quality

Ambient air quality in Maryland is determined by measuring ambient pollutant concentrations and comparing the concentrations to the corresponding standard. The term "ambient air" is defined by the EPA as "that portion of the atmosphere, external to buildings, to which the general public has access." The ambient air quality standards are classified as primary standards, secondary standards, or both.

The primary standards were established with allowance for an adequate margin of safety for protection of public health. The secondary standards were also established with an adequate margin of safety to protect the public welfare from adverse effects associated with pollutants in the ambient air.

In protecting public welfare, air pollution effects on the following are considered: soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, climate, property, transportation, economy, and personal comfort and well-being. The scientific criteria upon which the standards are based are periodically reviewed by EPA, and the standards are re-established or changed based upon the findings. The status of the national primary and secondary ambient air quality standards is briefly discussed below.

Nitrogen Dioxide Standard Status

The national primary (and secondary) air quality standard for nitrogen dioxide (NO_2) is 0.053 parts per million (0.1 milligram per cubic meter), annual arithmetic mean concentration. The standard is attained when the annual arithmetic mean concentration in a calendar year is less than or equal to 0.053 parts per million, rounded to three decimal places. Talbot County is classified as attainment for NO_2.

Carbon Monoxide Standard Status

EPA has established a primary 8-hour ambient air quality standard for carbon monoxide (CO) of 9 parts per million (10 milligrams per cubic meter), not to be exceeded more than once per year. A very short-term, 1-hour standard of 35 parts per million (40 milligrams per cubic meter), not to be exceeded more than once per year, has also been established. There is no secondary standard for CO in the ambient air.

Areas of non-attainment for CO standard(s) are classified as serious (16.5 parts per million and greater), moderate-2 (12.8 parts per million to 16.4 parts per million), and moderate-1 (9.1 parts per million to 12.7 parts per million). The Talbot County air quality region is in complete attainment with CO standards.

Sulfur Dioxide Standard Status

For sulfur dioxide (SO_2), EPA has established a primary 24-hour ambient air quality standard of 0.14 parts per million (0.365 milligrams per cubic meter), not to be exceeded more than once per year. In addition, a primary annual arithmetic mean concentration of 0.03 parts per million (0.08 milligrams per cubic meter) has also been established by EPA. The secondary standard for SO_2 is 0.5 parts per million (1.3 milligrams per cubic meter) over a 3-hour period, not to be exceeded more than once per year. Talbot County is classified as attainment with respect to SO_2.

Particulate Matter (PM10) Standard Status

The national primary (and secondary) air quality standard for particulate matter is 0.150 milligrams per cubic meter over a 24-hour period, not to be exceeded on more than an average of 1 day per year for a 3-year period. An annual arithmetic mean concentration of 0.05 milligrams per cubic meter has also been established for both the primary and secondary air quality standards. Talbot County is considered to be in attainment for particulate matter.

Ozone Standard Status

The primary and secondary ambient air quality standard for ozone is 0.12 parts per million (0.235 milligrams per cubic meter) over a 1-hour period, not to be exceeded on more than an average of one day per year for a 3-year period. Under the Clean Air Act Amendments (CAA) of 1990, Talbot County is in attainment for ozone; however, the entire State of Maryland is considered to be part of the Northeast Ozone Transport Region.

Lead Standard Status

According to MDE, the Talbot County area is in attainment for lead.

3.1.10 Noise

Uninhabited (or intermittently inhabited) islands have very few noise sources; most noise there is generated by natural occurrences. Noise levels around Poplar Island have not been measured, but background noise can be attributed to natural sources such as wind, waves on shore, and (in summer) bird colonies. The area is generally free of anthropogenic noise sources other than working boats (oyster, clamming, and fishing), occasional recreational boats and airplanes, and intermittent noise from human activities at the seasonal residences on Coaches and Jefferson Islands.

3.1.11 Hazardous, Toxic, and Radioactive Wastes (HTRW)

There are no known issues related to hazardous materials manufacturing, storage, or use on any of the island remnants or Coaches Island. No visual evidence of such materials or clandestine dumping was encountered during the walk-through surveys conducted as part of the field studies. Further, none of the extensive surveys conducted for identification of archaeological and historical sites in the area elicited evidence of hazardous materials, or a history of their use. The Baltimore District, USACE, conducted a search of Federal and state records, and no historical uses were identified that could be related to environmental liability issues. Based upon the findings of the walk-through surveys, the review of available aerial photographs, and the search of Federal and state records, the current and historical uses of the Poplar Island group and Coaches Island properties do not appear to pose a significant environmental liability concern.

3.2 Cultural Resources

Cultural resources within the Poplar Island archipelago have undergone many changes concurrent with the erosion of the island and its history of human habitation. Poplar Island has been populated by Native Americans, European colonists, and farmers. It once supported a resort town that was frequented by politicians, including several presidents. Poplar Island cultural resources have been separated into two categories, archeological and historical. Archaeological resources are categorized as occurring before European discovery. Historical resources are categorized as occurring after European contact. Archival research combined with a Phase I marine and terrestrial archeological survey was conducted for the Poplar Island project (Goodwin and Associates 1995) to assess the potential for both archaeological and historic resources. The project was undertaken in accordance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Phase I marine investigations identified six magnetic anomalies that warranted Phase II evaluation. The results of that Phase I survey and the Phase II investigation are summarized here.

3.2.1 Archaeological Resources

Poplar Island has been inhabited by humans for centuries. Prior to the colonization of the Americas by Europeans, Native American populations likely utilized the island as a food gathering area. Whether they actually lived on the island is unknown. Several investigations have documented archaeological sites on the Poplar Island group, seven of which are prehistoric. Lowery (1992) has recorded four prehistoric sites on Poplar Island, two prehistoric sites on Coaches Island, and one prehistoric site on Jefferson Island. Projectile points and oyster shell middens characteristic of several archeological periods have been discovered. Research conducted in support of this project (Goodwin and Associates 1995) indicated that many of these previously recorded sites have become submerged as the islands have eroded. Consequently, artifacts from these sites may be dispersed over a wide area. The recent survey included the four remnant islands and Coaches Island for a Phase 1A investigation. The following sections review the results of this survey within the context of archaeological resources.

North Point

One archaeological site had been previously recorded for North Point. This site is thought to represent an area of short-term habitation associated with the procurement of littoral resources (Lowery 1992). Pedestrian reconnaissance of the reported location failed to produce any evidence of the site. The recent survey documented North Point to be approximately 2.5 acres in overall size (Goodwin and Associates 1995). Recent observations of the island indicate a further decrease in island size. This reduction resulting from erosional forces increases the difficulty of finding archaeological resources on North Point that may still have integrity.

Middle Poplar Island

Middle Poplar Island, the largest and most physically intact of the smaller Poplar Island remnant islands, has one previously recorded archaeological site. Island reconnaissance during the Phase IA survey identified a previously unrecorded shell midden on Middle Poplar Island associated with this site (Goodwin and Associates 1995). No evidence of the previously identified archaeological site was observed. No other artifacts or observations were recovered during this investigation.

South Central Poplar Island

Three archeological sites had been identified on South Central Poplar Island (Goodwin and Associates 1995). Archaeologically, it is thought this area was used as a food gathering area (Lowery 1992). A pedestrian survey failed to obtain any additional evidence of any of these sites.

South Poplar Island

One prehistoric site had been located on this remnant. At the time of the field investigation, only a very small portion of the island, currently estimated to be less than 0.5 acres, was above water, and no evidence of the previously recorded site was observed.

Coaches Island

Coaches Island, which remains relatively protected from erosional forces, contains two previously recorded prehistoric sites. Due to some difficulty in pinpointing the exact locations of these sites, they were not re-identified. No other evidence of either site was observed during field studies on the island (Goodwin and Associates 1995).

3.2.2 Current Archaeological Setting

Only one site with potential archaeological resources was observed during Phase 1 ground level reconnaissance performed by Goodwin and Associates (1995). This site was a shell midden located on South Central Poplar Island thought to be in association with a previously recorded archeological site on that island remnant. No other previously recorded archeological sites on the Poplar Island archipelago were rediscovered. It is thought that these previously recorded sites may persist in fragmentary condition due to their continuous exposure from the destructive effects of wave action and storm activity of the Chesapeake Bay.

3.2.3 Historical Resources

What is now known as Poplar Island (the four remnants) was first recorded by Captain John Smith as "Winston's Isles" in 1608. The island was settled in 1632 as a result of expansion from Kent Island approximately 3 miles to the north. By 1637, "Popely's Island," as it was called, became a busy and productive plantation. An Indian attack in 1637 killed every resident on the island. By 1654, Poplar Island had again become a thriving plantation and remained so until the 18th century. In 1777, the island was raided by the British, who took all the livestock and burned every residence. Poplar Island figured prominently in both the Revolutionary War and the War of 1812. During the War of 1812, the British Navy took possession of the island as a rendezvous point.

From the early 1800's, Poplar Island supported agricultural production. By 1820, it had a population of 60 residents, and several stores and a school had been established to serve this resident population. By 1870, Poplar Island was beginning to suffer from the serious effects of erosion that would continuously diminish its landmass. By the First World War, the small Poplar Island village of Valliant, with a population of 45, was the last cluster of habitation. The harsh living conditions and dwindling amount of arable land forced the last permanent resident from the island in 1929 (MES 1994).

After the last full-time resident left Poplar Island, it became home to several small hunting shacks and, in the late 1930's, was the vacation home of Presidents Roosevelt and Truman. The presidential retreat house burned in 1946, and the island again supported only small hunting cabins. A 1952 aerial survey indicated that Poplar Island had been reduced to 115 acres. This was just over 11 percent of the 1640 land area, estimated at over 1,000 acres (Figure 1-3). Currently, two part-time residences, one on Jefferson Island and one on Coaches Island, persist despite continued erosion.

3.2.4 Current Historical Resources

In conjunction with the archaeological resource investigations, a Phase 1 investigation of historical resources remaining on 5 of the 6 islands in the archipelago was conducted (Goodwin and Associates 1995). A survey was conducted on the four Poplar Island remnants and Coaches Island to characterize existing conditions.

North Point

Few historical resources were recorded on North Point during the survey (Goodwin and Associates 1995). Anecdotal evidence indicates that North Point was predominately wooded during the historical period. This would seem to indicate that human habitation of this area was limited. Shovel tests were conducted on the North Point remnant, and historic period artifacts were recovered from the island surface. In addition, wooden posts/piers were identified along the shoreline of North Point. It is postulated they represent a pier remnant or bulkheading.

Middle Poplar Island

Field reconnaissance of this remnant island by Goodwin and Associates identified a previously unrecorded historic site at the extreme south/southeast end of the island (1995). An eroding well shaft and hand pump with associated brick architectural elements were noted. Several semiburied brick foundation piers were also noted. In conjunction with these observations, many historic period artifacts were observed, including glass, tableware, a charcoal lens, and an eroding brick floor.

South Central Poplar Island

A pedestrian survey identified post holes and a variety of historic period artifacts including stoneware, bottle glass, and bovine teeth (Goodwin and Associates 1995). In 1987, a wooden structure and associated ceramics were still present on the island, as noted by Lowery (1992). Limited evidence of this site was observed by Goodwin and Associates (1995). Three features and an artifact concentration along the eastern shore are thought to be related to the historic wooden structure noted by Lowery (1992). Brick rubble, submerged brick, ceramics, and glass were all found in close association with the degraded historic site.

South Poplar Island

At the time of the Goodwin and Associates (1995) survey, only a small portion of this remnant was above water. No historical sites or resources were observed in association with pedestrian reconnaissance conducted at the site.

Coaches Island

No historic sites were identified on Coaches Island during the Phase 1A or 1B investigations by Goodwin Associates (Goodwin 1994, 1995). No historic period artifacts were collected during the archeological investigations of this island.

3.2.5 Marine Survey of Archaeological and Historic Resources

The Poplar Island archipelago, as part of the mid-Bay region, has had a long history of shipwrecks. In addition, the history of Poplar Island would indicate that many of is residents may have made their living from area waters. There is potential for submerged vessels with some historic value to be present within the current project alignment. An investigation of the potential for historic maritime resources by conducting a reconnaissance level survey using a magnometer and radio-acoustics in the aquatic portions of the study area (Goodwin and Associates 1995). The survey was conducted utilizing magnetometer and sub-bottom profiling apparatus to identify both ferrous and non-ferrous anomalies. The testing methodology was sufficient to identify all potential cultural resources in the project location. Nineteen magnetic and acoustic anomalies were recorded in this survey: five showed some associated sub-bottom disturbance. Eleven had no accompanying magnetic perturbation and are considered composed of non-ferrous substances.

Phase 2 evaluations were conducted of six marine anomalies identified during earlier underwater investigations for the Poplar Island Restoration project. These investigations were carried out during August and September 1995. This project was conducted in accordance with the NEPA of 1969, with Section 106 of the NHPA of 1966, as amended, and with Article 83B, Sections 5-617 - 618 of the Annotated Code of Maryland.

The Phase 1 investigations identified 28 magnetic and acoustic anomalies. Additional Phase 2 sub-surface testing was recommended for six target areas within or adjacent to the Alternative Alignment No. 1 project area. The submarine survey comprehensively surveyed all portions of the project location with sufficient water depth to permit the successful operation of the remote sensing equipment. However, as shown on Figure 3-18, portions of the project area adjacent to the islands could not be surveyed electronically, due to shallow water depth of less than 3 1/2 feet. In consultation with the State Historic Preservation Office (SHPO), the archeological team tested the near-shore locations with standard sampling methods, consisting of the use of hand-held dredge tests. No additional archeological sites were encountered using this testing method.

These Phase 2 investigations included a combination of visual search, metal detecting, probing, and excavation. Their purpose was to provide data concerning the integrity and National Register potential of submerged cultural resources. The six anomalies to be tested were 10-727, 10-755, 30-1151, 40-665, 48-819, and the cluster of targets at 58-1477, 60-579, and 62-1508. Each is briefly discussed below and is shown in Figure 3-18.

Anomaly 10-727—The initial sub-bottom profile record of this anomaly showed a narrow, very hard, vertical target extending deep into the substrata. The magnetometer registered an anomaly in the same location. Phase 2 investigations involved relocating the target by going over the area with the magnetometer on a 25-foot grid. Three separate circle searches were conducted at 10-foot intervals for a distance of 70 feet from the buoy (140-foot diameter). The divers probed the bottom as they searched. No sign of the target, or of any other cultural material, was located. This anomaly could not be located despite intensive bottom survey, and, therefore, no further work was recommended.

Anomaly 10-755—This target was identified as a small surface mound accompanied by a 32-gamma magnetic anomaly. The target was relocated with the magnetometer, and the bottom was searched. A 6- x 30-foot concentration of amorphous ferrous material was identified. This material may represent either a pile of corroded sheets of very thin metal, or a deposit of bog iron. There was no indication that the material was manmade; no fasteners or fastening holes were identified. This target is not considered potentially eligible for listing in the National Register of Historic Places. No additional investigation is recommended.

Anomaly 30-1151—This sub-bottom profile target showed a hard, reflective surface curving downward from the surface of the Bay floor to about 1 meter below surface. This target was postulated to represent a shell midden. This target was relocated and a bottom search was made. The bottom was sandy and did contain a lens of oyster and clam shells. The shell was scattered throughout the upper 1 1/5 feet of sand. This shell lens overlays hard packed sand. This hard-packed sand layer may have been what caused the initial sub-bottom profile reading.

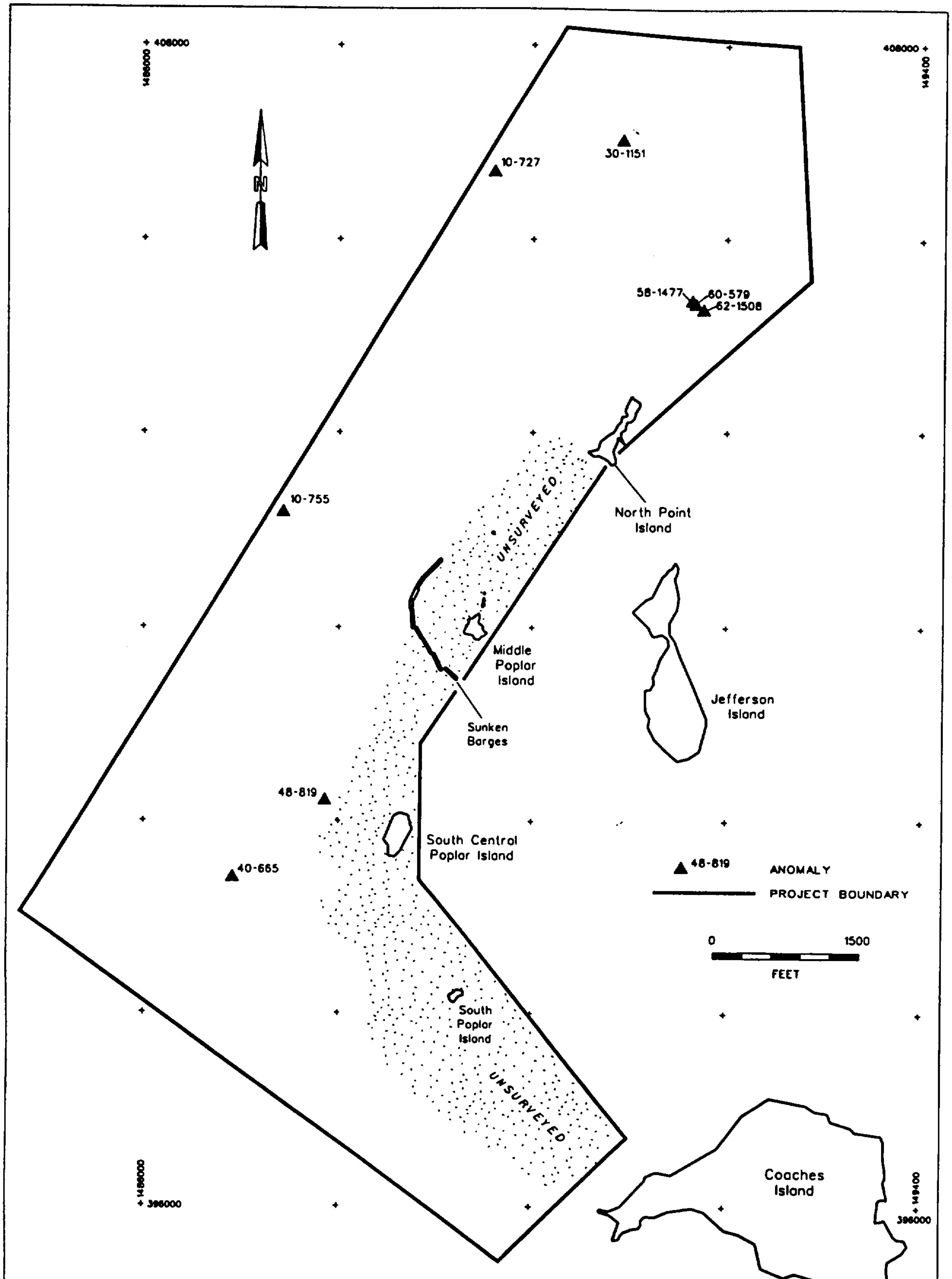


FIGURE 3-18

Location of six target areas recommended for sub-surface investigations.

Four dredge tests were performed in this shell deposit, and the shell was retained for analysis. Preliminary analysis does not suggest that the shell deposit has a human origin. The shell appears to be recent; it was scattered loosely in the sand and did not have the density of a cultural shell midden.

Anomaly 40-665—This anomaly represents a moderately strong (60 g) magnetic target without an accompanying acoustic signature. The anomaly was relocated with the magnetometer, and the bottom was searched. The area was characterized by a 1- to 2-foot sand cap over clay. There was a scattering of stones in the area, blocky quartz stones and flat black sandstone. Some of the stones were large. A piece of rebar also was identified, which may account for the magnetic signature. No archaeological site was identified. No further investigation was recommended.

Anomaly 48-819—This anomaly appeared as a U-shaped target on both the sub-bottom profile and fathometer records. The magnetic record displayed a moderately strong anomaly of significantly long duration and a multicomponent signature. The U-shaped signature commonly is associated with sunken vessels and the target was postulated to represent a small watercraft.

The target was relocated with the magnetometer, and two 70-foot circle surveys were conducted. The area was characterized by a clay bottom; however, sand had collected around two objects: an iron furnace remnant and a dead tree that had collected miscellaneous debris (a brick fragment, a piece of iron pipe) in its branches. The tree branch had a crescent shape, which may account for the U-shaped signature on the original sub-bottom profile and fathometer records. No other cultural material was identified. This collection of debris did not represent a coherent site. No further work was recommended.

Anomalies 58-1477, 60-579, and 62-1508—This was a cluster of acoustic and magnetic targets which included an acoustic target that resembled an open-topped box with straight vertical sides and a flat bottom. This was surrounded by a large area of disturbed surface and a hard reflective layer approximately 1 meter below the bottom. The size of the anomaly suggested the potential for a buried structure. The targets were relocated, and diving searches were conducted on all three anomalies. The area was probed as it was searched. Nothing was found in the area except a flat, featureless clay bottom. It is possible that the hard, reflective layer identified in the Phase 1 survey was the hard clay bottom. Perhaps the rectilinear feature was a crab pot that since has been removed. In any case, there was no evidence for the postulated structure; no cultural material of any kind was identified. No additional investigation was recommended.

3.3 Socioeconomic Resources

The Poplar Island region is considered a productive and integral part of the socioeconomic framework of Talbot County. The socioeconomics of the Poplar Island region are closely tied to commercial and recreational activities associated with the Chesapeake Bay. Land and water use, demographics, employment, and industry are discussed in the following sections.

3.3.1 Land and Water Use

The area surrounding the archipelago provides a suitable natural environment for individuals who crab, fish, or collect shellfish. Each of these resources contributes significantly to the economic well-being of the region. As a result of the seasonal nature of these species, these waters are utilized virtually year round. Another commercial use of the waters surrounding the archipelago is transportation and commercial shipping. The main shipping channel in this reach of the Bay passes approximately 2 miles from the archipelago. This navigation network is a critical component of the regional economy in the mid-Atlantic area. Finally, this region contains monitoring stations that provide regional data on biotic and chemical constituents of Bay waters. This information is utilized in various projects researching the health of the Bay system.

Land use of the Poplar Island archipelago itself is limited. Historically, Poplar Island supported agrarian and livestock farming operations (Goodwin and Associates 1995). Due to the erosion of the island, the existing archipelago no longer supports these human activities. Coaches and Jefferson Islands, the two largest of the six remnant islands, are inhabited occasionally but provide little socioeconomic value. Other than providing limited blue crab habitat in the salt marshes, the four remnants have no socioeconomic value.

3.3.2 Demographics

The project area and Talbot County are rural in nature with a low density population relative to other urban centers such as Annapolis and Baltimore. In 1990, approximately 30,549 individuals resided in Talbot County (U.S. Bureau of Census). Projections of population growth indicate the 1995 population to be 32,100 (Maryland Department of Employment and Economic Development [MDEED] 1995). In 1990, approximately 1,915 individuals resided in the Bay Hundred election district, which encompasses the Tilghman Island peninsula (Figure 3-19). This amounts to 6.3 percent of the total Talbot County 1990 population, but reflects a population decline of 5.3 percent (Table 3-20). The largest population center in closest proximity to Poplar Island is St. Michaels, with a 1990 population of 1,301 (U.S. Bureau of Census 1990). There are no permanent residents on Poplar Island. Two part-time residences exist: one on Coaches Island (the largest remnant) and one on nearby Jefferson Island.

It is important to note that Bayside towns of Talbot County are popular destinations for tourists. Many towns, such as St. Michaels and Oxford, experience significant seasonal increases in population. Recreational activities associated with sailing and power boating contribute significantly to the local economy in these areas.

It is assumed that low income or minority populations use the project area, although the exact number of users is unknown. One of the reasons this number is difficult to determine is that some users probably do not reside in Talbot County. It is assumed that some area commercial fishermen are members of low income populations.

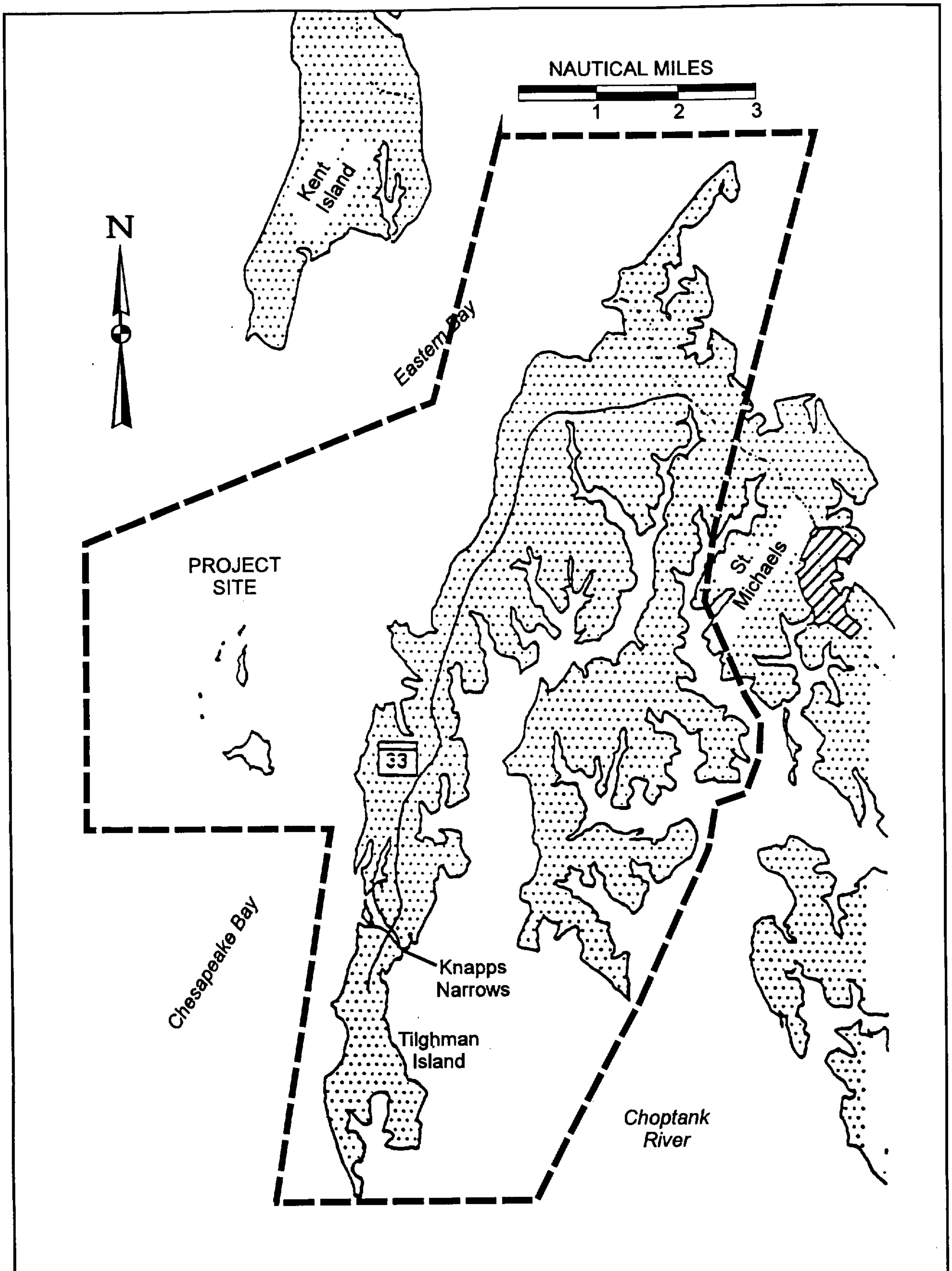


Figure 3-19 Map of Bay Hundred Region.

Table 3-20 Talbot County Regional Population Growth By Jurisdiction, 1970-1990

	1970	% of Count	1980	% of Count	1990	% of Count	Change	% of Change
Talbot County								
(Election Districts)	23,682	100.0%	25,604	100.0%	20,549	100.0%	6,867	29.0%
Easton	11,167	47.2%	12,172	47.5%	15,470	50.6%	4,303	38.5%
St. Michaels	4,431	18.7%	4,639	18.1%	5,298	17.3%	867	19.6%
Trappe	3,366	14.2%	3,495	13.7%	4,111	13.5%	745	22.1%
Chapel	2,751	24.6%	3,337	13.0%	3,755	12.3%	1,004	36.5%
Bay Hundred	1,975	8.3%	1,961	7.7%	1,915	6.3%	(60)	-3.0%
Incorporated Towns								
(Total)	9,592	40.5%	10,371	40.5%	12,457	40.8%	2,865	29.9%
Easton	6,809	28.8%	7,536	29.4%	9,372	30.7%	2,563	37.6%
St. Michaels	1,456	6.1%	1,301	5.1%	1,301	4.3%	(155)	-10.6%
Oxford	750	3.2%	754	2.9%	726	2.4%	(24)	3.2%
Trappe	426	1.8%	739	2.9%	947	3.1%	521	122.3%
Queen Anne (pt)	151	0.6%	50	0.2%	111	0.4%	(40)	-26.5%

3.3.3 Employment and Industry

The majority of individuals in Talbot County (26 percent) are employed in manufacturing, trade, or distribution industries. Other major industries include professional and technical (15 percent) and government (8 percent) based on MDEED 1995 data. A further breakdown of the employment statistics reveal that 892 individuals, or 5 percent of the work force, are employed in trades associated with farming, fishing, or forestry. The number of individuals actively engaging in fishing activities is not provided for Talbot County. However, in 1995, there were 7,806 commercial fishing licenses granted in the State of Maryland.

Commercial fishing in the Chesapeake Bay is primarily the work of small-scale operators. In the entire Chesapeake Bay in 1985, approximately 60 percent of the fishermen held crab-pot licenses and 44 percent of fishermen were licensed to fish with a gillnet (Kirkley 1987). In 1995, 73 percent of commercial fisherman (Maryland waters only) held crab-pot licenses, and 13 percent were licensed oyster harvesters.

Table 3-21 presents weight and dollar value of selected commercial fisheries landings for the Maryland portion of the Chesapeake Bay, by year, from 1980 to 1993 (Carter 1995, DNR 1995). The portion of income derived from Poplar Island waters cannot be extracted from these data. Currently, the area surrounding the archipelago contains two licensed oyster bars (NOB 8-11 and NOB 8-10). Additionally, razor clam beds, soft-shell clam beds, pound nets, and crab line areas exist either directly within or adjacent to the Poplar Island archipelago (Figure 3-15). Anecdotal evidence indicates that a substantial soft clam harvest has occurred within archipelago waters in past years. The area has been harvested since the 1940's, with harvests reaching levels of 1,000 bushels per acre (over a 3-year time frame) (Nichols 1995). However, population levels of soft clams vary considerably from year to year, and recent information indicates this species is not abundant (Outten 1995).

Oyster bars in the area have not been extensively harvested in recent years; however, both have the potential to be productive. Razor clams (used for bait) have been harvested in the southern part of the archipelago (Nichols 1995). It is not known how this shellfish species has contributed to the overall catch and income of watermen in the region.

Menhaden and striped bass are actively fished in and around the Poplar Island archipelago. Currently, 74 striped bass collection permits have been issued for the Tilghman Island region. It is unknown how many permit holders actually fish for striped bass and how many of these fish are collected from archipelago waters. There is some indication that a fishery for various species occurs during seasonal migration periods. At least one actively fished pound net was present in waters adjacent to the proposed dike alignment in the summer of 1995, and additional nets were observed during seasonal studies (EA 1995a,d). Landing data from the pound net fishery over the last 5 years (Table 3-22) indicate that several species have been collected from pound nets located either on or within the greater Tilghman Island region. The primary species captured during this period are striped bass and menhaden. Fishing was also concentrated during the summer, spring, and fall. Little or no catch was recorded during the winter. The

Table 3-21 **Weight And Dockside Values Of Selected Commercial Fisheries Landings From Noaa Code Area 027 Of Maryland Chesapeake Bay, By Year, 1980-1993**

	Species											
	Blue Crab (sum of hard and soft)		Soft Clam		Oysters		Bluefish		Summer Flounder		Herring	
Year	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value
1980	9,843,321	2,458,455.51	133,323	293,728.25	431,744	614,722.88	18,739	1,761.32	2,496	1,169.54	4,733	384.37
1981	13,009,180	3,690,383.45	240,930	444,015.00	219,171.20	318,697.00	31,172	3,960.43	1,391	948.66	1,741	170.33
1982	6,845,002	2,498,498.62	34,878	73,956.00	382,697.60	637,989.00	35,930	5,840.22	1,118	742.33	980	218.47
1983	14,625,777.39	5,527,785.31	54,840	115,886.00	139,789.95	239,468.75	25,276	3,996.38	4,861	2,944.70	5,358	886.60
1984	9,757,738.11	3,015,833.77	108,294	265,780.45	337,558.80	844,881.00	26,228	3,391.16	2,420	1,661.00	933	122.84
1985	10,250,923.44	3,547,991.51	565,821	1,561,590.95	365,795.14	687,432.85	95,555	15,656.57	280	274.83	2,048	346.67
1986	11,229,840.33	3,985,591.64	65,322	229,613.50	300,606.53	719,071.10	82,712	11,551.88	937	1,109.65	7,800	1,106.43
1987	7,395,634.07	3,633,006.93	695,538	1,219,445.50	140,302.40	464,002.50	112,917	23,613.02	3,304	5,219.69	4,496	1,054.85
1988	7,406,461.73	3,056,211.95	1,609,056	3,242,374.30	82,800	260,191.00	298,090	40,023.20	3,432	4,986.24	9,143	1,863.67
1989	7,299,058.93	3,614,613.22	638,619	1,441,682.45	75,281.60	273,218.00	56,904	12,910.05	743	1,624.96	10,103	1,258.03
1990	8,037,494.22	3,594,004.45	299,598.12	1,342,934.70	69,014.40	269,291.00	64,070	13,974.88	691	1,689.26	2,709	762.30
1991	8,069,785.81	3,255,227.10	387,315	1,228,138.25	217,379.20	694,981.70	38,722	8,652.45	376	461.99	2,711	512.04
1992	4,527,207.69	2,595,812.56	41,031	116,929.00	109,019.20	360,756.00	9,272	2,477.29	2,486	3,696.58	840	185.754
1993	12,169,370.11	6,415,688.02	501,954	2,085,606.70	8,568	29,689.50	3,415	1,628.99	1,078	1,464.29	291	60.64

Table 3-21 (continued)

	Species							
	Menhaden		Striped Bass (sum of large, medium, and small)		White Perch		Sea Trout, Grey	
Year	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value	Pounds	$ Value
1980	667,484	36,128.66	439,909	381,622.27	28,624	10,183.69	1,968	463.42
1981	937,953	55,398.03	93,086	116,265.89	8,188	3,254.45	4,313	1928.71
1982	781,558	46,464.91	36,034	52,770.93	8,574	4,432.45	14,517	8561.70
1983	784,670	30,781.32	24,857	63,316.29	4,196	2,502.95	4,599	3248.56
1984	304,002	15,264.70	135,261	332,572.95	9,713	4,782.02	3,737	2053.39
1985	348,625	18,045.95	29	-0-	522	201.24	6,229	4204.53
1986	156,317	10,300.17	3,125	3,125	340	185.28	12,161	7050.16
1987	510,910	33,478.78	13,113	-0-	955	557.89	16,217	12423.82
1988	335,822	22,366.64	18,062	-0-	1,098	513.83	6,502	5681.22
1989	2,154,805	151,384.24	9,188	-0-	2,254	1,551.48	1,4156	14424.82
1990	769,070	72,414.94	8,710	12,802.38	4,666	2,904.30	2,853	3320.93
1991	1,286,594	704,322.11	71,171	132,540.56	11,054	7,210.35	544	481.43
1992	831,237	80,835.38	110,204	176,243.24	6,926	6,667.05	685	672.21
1993	794,026	80,282.37	288,137	463,639.81	20,602	16,991.02	95	113.07

monetary value of this catch is difficult to ascertain. Information related to the pounds of fish landed (Table 3-21) indicates that this region is productive and contributes economically to the region. No other records exist for other pound net sets within the archipelago. At least one other site has been recorded and is currently being fished. Records indicate that as many as four sites either adjacent to or within the archipelago have contributed to the pound net fishery in the area (MES 1994). Other gear (e.g., gill nets) are not utilized to the extent of pound nets. Records indicate that gillnets, fyke nets, and fish pots have been used successfully to collect various fish species within the Poplar Island region (Goshorn 1995).

Crabs and crabbing also contribute significantly to the economic setting of Talbot County and support commercial harvests in other Bay communities. Crabbing is ubiquitous throughout the Bay region. Nearly every productive bottom from the mouth of the Bay to its confluence with the Susquehanna River is actively fished for crabs (at some point during a season). Seasonally, locations of crab pots are changed to reflect movement of the species. During the spring and fall, deeper locations are often fished. This would include only the fringes of the archipelago. During the summer months, shallow water areas are fished, including most all of the Poplar Island archipelago. Observations from the summer quarterly report indicate that crab lines were placed in all sections of the archipelago including Poplar Island Harbor (EA 1995c). The percentage of crabs taken from this region is difficult to estimate, although the extensive area fished indicates this is a productive region.

3.4 Aesthetics and Recreational Resources

The middle Chesapeake Bay, which encompasses the Poplar Island region, is a widely used recreational and aesthetic resource enjoyed by many different individuals in a variety of pursuits. Consequently, a high value is placed on these resources in the mid-Chesapeake Bay region. The Poplar Island archipelago helps to maintain the current high quality of these resources. Recreational and aesthetic resources in the archipelago are typical of most mid-Bay areas. This region supports a high number of seasonal recreational activities including water sports (i.e. boating, sail-boating, fishing, and hunting). One common theme associated with all these recreational activities is that an aesthetically pleasing environment is integral to most.

3.4.1 Aesthetics

The mid-Bay region is considered to have a high aesthetic value. This region of the Bay, sometimes called the Bay Hundred, has a limited amount of shoreline development and many natural features such as coves, rivers, and protected areas that provide scenic vistas to both the shoreline observer and the boater. The Poplar Island archipelago, which is located in this region (Figure 1-2), contains many similar natural features. Very little development exists on the islands, and there is little visible evidence of human presence.

Few island environments still exist in the middle portions of the Chesapeake Bay. In general, islands help to diversify the landscape and add to the aesthetic appeal of the region. Historically, islands played a much larger role in the natural setting of the Chesapeake Bay than they do today. Erosional forces have greatly reduced the land area of most islands throughout the Bay region.

Table 3-22 Commercially Reported Pound Net Catch (1990-1994) in the Vicinity of Poplar Island

Year	Species	Catch (lbs)
1990	Menhaden	521,416
	Striped bass	153
	Bluefish	2,440
	Summer Flounder	25
1991	Menhaden	800,700
	Striped bass	775
1992	Menhaden	457,422
	Striped bass	10,665
1993	Menhaden	703,801
	Common eel	3,200
	Black Drum	3,404
	Bluefish	815
	Striped bass	11,141
1994	Menhaden	356,259
	Striped bass	6,593

The existing six islands that comprise the Poplar Island archipelago are subject to severe erosional forces (MES 1994). These same erosional forces have reduced the relief of the archipelago to the point where the majority of the islands (excluding Coaches and Jefferson) are not visible from a distance (e.g., from Poplar Channel). Coaches and Jefferson Islands provide the only appreciable topographic relief at this time.

The four smaller remnants of the Poplar archipelago are dominated by marsh grasses, and they experience partial to complete inundation during high tide events. It is estimated that maximum relief above MSL for these islets is no more than 4 feet. The two larger parcels (Coaches and Jefferson Islands) are wooded in the center with a periphery composed of marsh grasses, intertidal ponds, and other wetland features. The wooded areas are dominated by deciduous trees interspersed with loblolly pine. It is estimated that at its highest point, the maximum relief above MSL is approximately 8 feet for the two wooded islands.

Close inspection of the six remnants reveals the influence of nearby human activities. Due to the island's location, refuse from boaters and other shoreline areas washes ashore and accumulates. On the more exposed areas of the archipelago, especially those within the high tide range, debris associated with Bay activities (crab floats and pots, fishing lines, and boating items) is visible at close range.

A very low level of human activity has been observed on the remnants. Two residences, one on Coaches Island and one on Jefferson Island, are occupied on an infrequent basis. Because most of the surrounding waters are shallow and the area is some distance from the closest mainland port, there are few visitors other than seasonal residents. Private property warning signs on Coaches and Jefferson islands likely deter intruders from using these remnants. During baseline biological and water quality surveys (EA 1995a,b,c,d), an inspection of the shoreline areas in conjunction with other survey components indicated little evidence of human disturbance (e.g., fire rings, ashes, camping remains) on the other existing remnants.

The continued erosion of the archipelago has had a detrimental effect on the aesthetic value of these islands. Continued erosion of the shoreline has reduced the areal extent of the islands, rendering many of them barely visible during high tide. Sediment plumes from erosion of the islands occur throughout all seasons and under most conditions. The reduced visibility in the area hinders fishing and other water sports, which require clear visibility, and the mud banks associated with the erosion limit access to the islets.

In general, the Poplar Island archipelago can be considered a region with a high quality aesthetic environment; however, reduction in the island landmass due to extreme erosional forces has diminished the visual and aesthetic diversity that historically enhanced this area of the Chesapeake Bay.

3.4.2 Recreation

A variety of recreational activities occur within the Poplar Island archipelago depending on season and weather conditions. The most popular recreational activity in the area is fishing. In 1993, in the south-central portion of the Chesapeake Bay, 254 charter boats recorded 7,234 trips involving 42,758 people. Tilghman Island has a large charter fishing fleet that operates during the spring through fall period. During the winter months, sea duck hunting is a popular activity, and many licensed gunning rigs operate in the area.

Fishing

Fishing is likely the most common recreational activity that occurs within the Poplar Island archipelago. Placement of barges some years ago prevented the erosion of a portion of Middle Poplar Island and promoted fishing within the area between the barges and the islet. This area contains many snags, the submerged remnants of a forest that provide cover for fish. The region known as Poplar Island Harbor also contains many stumps and logs that provide cover and habitat. Fishing for several species, including striped bass and sea trout, is especially popular during seasonal migration periods. Fishing in other areas of the archipelago is limited because of the shallow, open water and the lack of suitable habitat.

Boating

Boating is central to many Bay activities, including recreational pursuits. In the Chesapeake Bay, power boaters, waterskiiers, and sailboaters all utilize portions of the Bay waters. St. Michaels, near Tilghman Island (Figure 3-20) is a popular destination for boaters in this region. The waters surrounding Poplar Island often preclude boating for all but the shallowest draft vessels. Consequently, except as a navigational landmark, most boating activities bypass the project area.

Hunting

Historically, the island was considered an excellent waterfowl hunting area. Hunting camps were established on the island during the 1940's and 1950's (MES 1994). The decline in waterfowl populations followed by restrictive hunting seasons contributed to the decline of this activity Baywide, including on Poplar Island. The current status of hunting activities within the archipelago are unknown. Some evidence of recently spent shell casings and decoys were observed on Coaches Island during seasonal baseline surveys. No operational waterfowl blinds were observed during existing conditions surveys. It is likely that hunting for sea duck species (e.g., elders, scoters, buffleheads) occurs within the 1847 footprint. Concentrations of these species were observed during the winter survey (EA 1995b). Generally, hunting locations for these species are well offshore and change with the seasonal patterns of the ducks hunted. A small population of whitetail deer, which is exposed to some hunting pressure, exists on Coaches Island. However, because of the small size of the herd, only a limited amount of hunting could occur before the herd would be reduced to levels unable to support a harvest.

Other Recreational Activities

The Poplar Island archipelago is a well-known bird rookery and bird watching area. Herons, egrets, cormorants, and other species utilize the archipelago during the nesting season. This activity attracts bird watchers to the area. This activity is highest during the spring and fall migration periods.

Sightseeing is another recreational activity that occurs near the Poplar Island archipelago. Poplar Island has a long history that attracts people who want to view the island. Interest in the island has been stimulated by a number of books, articles, and television programs that have featured Poplar Island. This contributes to the number of sightseers who visit the archipelago.

3.5 Most Probable Future Without-Project Conditions

The without-project condition is defined as the most likely condition expected to prevail over the length of the planning period (in this case, 20 years) in the absence of the Federal government implementing a plan of improvement. The without-project condition provides the baseline condition for any impacts associated with any improvements.

Without this project, the four separate islands, which now comprise just over 5 acres and which are eroding at the rate of more than 13 feet a year, will disappear completely just as 10,500 acres of other island habitat has in the Chesapeake Bay over the past 150 years. When the islands disappear, so too will the nesting snowy egrets, cormorants, little blue herons, black ducks, willet and osprey that the islands currently support. In addition, the continued erosion of the islands will continue to contribute to the Chesapeake Bay sediment loadings and have a negative impact on the water clarity in the immediate vicinity of the islands. This will result in a continuation of the persistent turbidity that is currently present.

If this project is not undertaken, the MPA will need to locate a suitable placement site in order to accommodate the approximately 38 million cubic yards of material that would be dredged from the approach channels in the upper Chesapeake Bay and placed at Poplar Island. Current MPA projections are that there will be a 34-million cubic yards shortfall in dredged material placement volume over the next twenty years. This shortfall is based only on the annual maintenance that will be required for the upper Chesapeake Bay approach channels, since this is the only material that is being considered for placement at Poplar Island. Due to the amount of time required to identify and develop a placement site, the material dredged as a result of any required maintenance dredging would be taken to HMI as long as there is sufficient capacity. HMI is expected to be filled by 1998; this action would result in the deferral of both maintenance dredging and any identified new work dredging until an alternative site is developed.